The Magazine for Sinclair users and Timex/Sinclair users

$2.95

SYNC®

March/April 1983

Volume 3, Number 2

GAMES:
- Minotaur
- ZX Maze

HARDWARE:
- System Expansion
- Regulated Power

MATH:
- Understanding Numbers

MACHINE LANGUAGE:
- Looping the Loops
- Storage in REM

THEME SECTION:
SYNC ON THE JOB
- Managers
- Accountants
- Photographers
- Engineers
- Builders
- Psychologists
- Archaeologists
- Teachers
- Students

01606 12339 25034 SYNC
ANDREW KENNEDY
2 CALUMET AVENUE
WORCESTER MA 01606

ROM-PAC APPLICATIONS HAS PROGRAMS ON PLUG-ON ROM CARTRIDGES FOR THE ZX-81

*EDUCATIONAL PROGRAMS
*APPLICATIONS
*GAMES

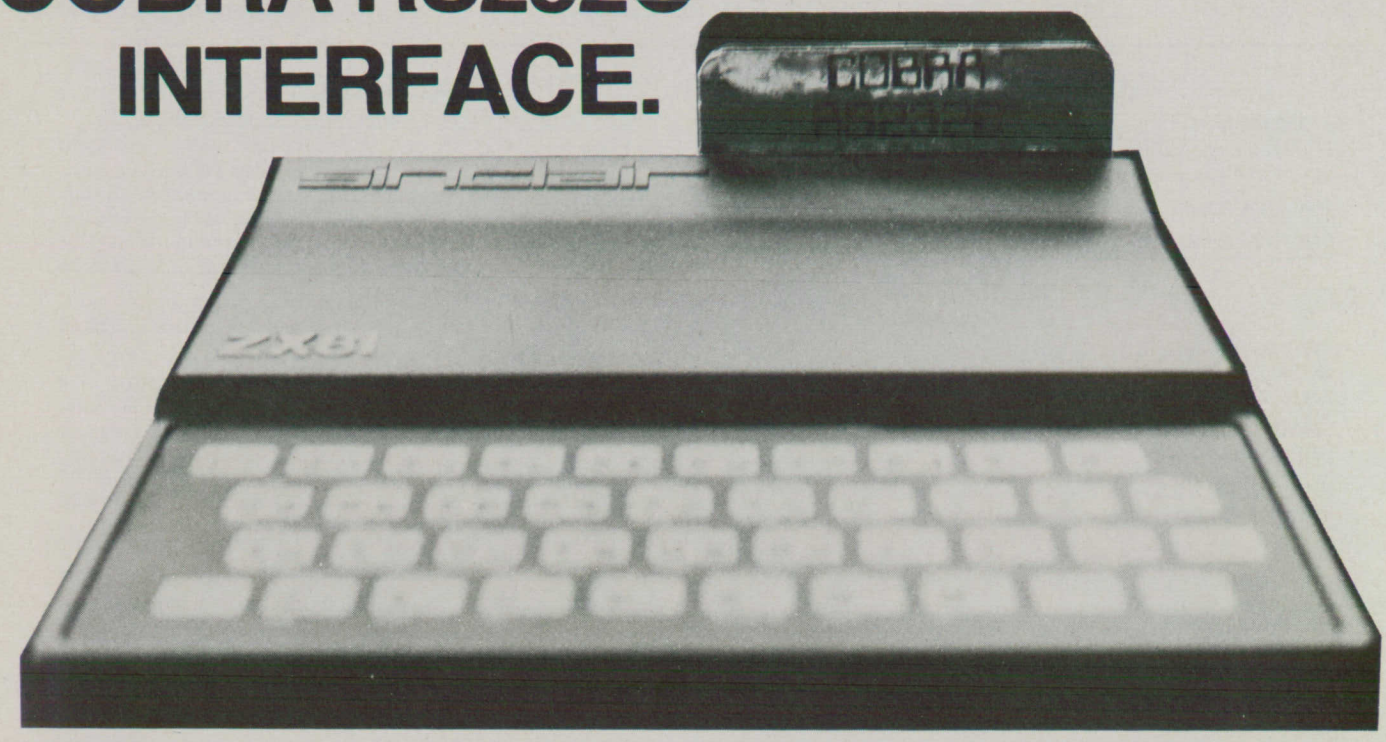
Call or Write For Your
FREE
Information Package Including:
*Current list of products and prices
*Operating instructions for all products
*Sample applications
*Adds you to our mailing list to receive new product news
*Updates on using the Sinclair with and without our products

CALL 404-921-4471
OR WRITE

ROM-PAC APPLICATIONS
5921-A Alhambra
Norcross, Georgia 30093

Due to possible trademark infringement Sinclair Applications is now operating under the name of Rom-Pac Applications. Neither Sinclair Applications nor Rom-Pac Applications has or have had any connections with Sinclair Research Ltd.

COBRA RS232C INTERFACE.



At last, a high quality RS232C interface for the ZX81 (TIMEX 1000) to connect you to any RS232C printer.
Look at these features:
Variable baud rate by software control. Upper and lower case printout. Up to 120 characters per line with software control. Handshake facility. Comprehensive manual with every unit. Fits on the back like a RAM pack. Uses the ZX(TIMEX) power supply. Output via 2 small jack sockets.
AT AN INTRODUCTORY PRICE OF ONLY $50.00 + $6.00 shipping.

COBRA CENTRONICS INTERFACE

The same high quality as the RS232C except for the output being via a 24 way socket. Both interfaces have the same features. AT AN INTRODUCTORY PRICE OF ONLY $50.00 + $6.00 shipping. We also make every type of lead and plugs for the above interfaces, typical prices.

25 way "D" connector with leads for above 232 $15.00
4 way DIN plug and leads for the above 232 $15.00

AVAILABLE JANUARY.

Another first from COBRA. A truly intelligent RS232C interface. With this interface 2 ZX(TIMEX) computers can communicate with each other along any usable medium ie telephone, radio etc. Such information as listings, data strings and programs can be passed between any number of computers very simply. The price is also unbelievable. For more details tick box below.

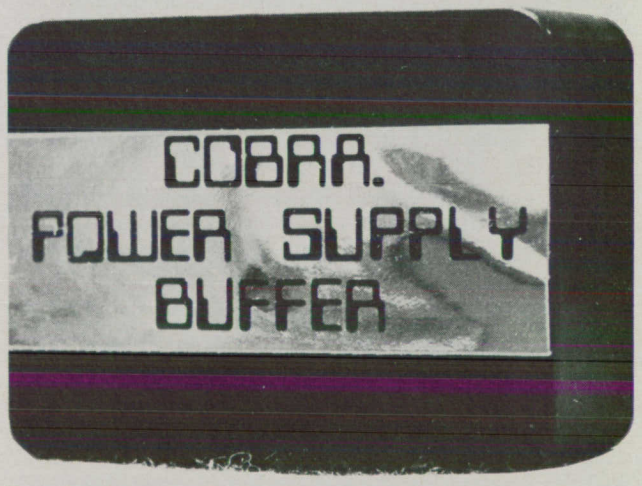
Please rush me your (tick required)

RS232C interface at only ..... $50.00 ☐
Centronics interface at only ..... $50.00 ☐
Power supply buffer at only ..... $22.00 ☐
Leads for the interface ..... $15.00 ☐
The free brochure from COBRA* ☐
More details of your 232 MODEM* ☐

TOTAL _____

Don't forget to add shipping to your order
*Please send a stamped, self-addressed envelope for brochure.

COBRA POWER SUPPLY BUFFER.



Ever had hours of programming work lost in a moment owing to fluctuations in power or accidental switching of the wrong mains plug?
The Cobra power supply buffer prevents such occurrences affecting you. It is fitted between the Sinclair (Timex) power supply and the computer. During loss of power to the computer the buffer will continue to power the computer with a 9 volts supply for up to 30 minutes or more. It also has mains filtering circuitry to prevent spikes getting through to the computer. The unit will recharge itself during normal power on conditions. When a mains loss situation occurs a red LED will warn the user of loss of electricity supply.
THE PRICE IS ONLY $22.00 + $7.00 shipping.

Cobra Technology Limited, 378 Caledonian Road, Islington, London N1 1DY U.K.

Sinclair Place

P.O. BOX 2288 REDMOND, WA 98052

dK'TRONICS

KEYBOARD—Fully cased with internal motherboard. 9"Wx15"Lx-2½"H. 52 key with 12 key numeric pad. Room for internal add-ons or can use with standard external add-ons.....**$88.00**

16K RAM for dK'TRONICS keyboard-internal plug on...**$39.50**

64K RAM for dK'TRONICS keyboard-internal plug on. .**$98.50**

HAVEN HARDWARE

These are uncased, good quality units.

KEYBOARD—Plug on, no soldering. 3⁷/₈"Wx9⁷/₈"Lx 1¼"H. KC10002 keyswitches - 90 gr. force, 3.5mm travel. Includes repeat key.....**$55.00**

HH I/O PORT—Plugs on. 8 input, 8 output ports. LED at each output. ONBOARD CLOCK included.....**$29.50**

HH INVERSE VIDEO—fits inside computer, solders on. Switch can be added to change between Normal and Inverse.....**$11.00**

HH REPEAT KEY—for editing-variable speed-solders on..**$12.00**

HH PROGRAMMABLE CHARACTER GENERATOR—2³/₈"Wx3⁷/₈"L. Standard letters, etc. are kept but inverse characters may be mixed or interchanged with 2 sets of programmable characters. 8x8 matrix. Written by 8 POKE ommands. 5 internal connections. Edge connector left free for plug ons.....**$49.00**

WM. STUART SYSTEMS

BIG EARS—6"x5"x2". Speech recognition system. Steel cabinet with leatherette finish. Brushed aluminum face. Connects through an I/O port to computer. Microphone and cables included. Words are stored as voice patterns which the system learns from repetition by the user. Requires an I/O port.....**$99.00**

I/O PORT & MUSIC SYNTHESIZER—Uncased 3½"x3½". Plugs between computer and RAM pack, if used. 3 independently programmable Tone Generators. As an I/O Port, the input-output is arranged as two 8-bit bidirectional ports under software control. Direction is selectable for each port independently. Does not consume address-space or restrict memory expansion. Full documentation included.....**$68.00**

FAST LOAD PROGRAM—Speeds BIG EARS learning.....**$19.50**

SPEECH SYNTHESIZER—5¾"x4"x2³/₈". Self-contained. Uses phonemes. Nearly unlimited vocabulary. Comes with internal speaker as well as external speaker jack and "Big Ears" interconnection. Interface allows use of RAM packs, printers and other add-ons.....**$99.00**

MUSIC COMPOSER PROGRAM—Use with or without Music Synthesizer.....**$19.50**

PACKAGE—Big Ears, Synthesizer, Music Synthesizer and I/O Port, Fast Load Program. Save $35.50.....**$250.00**

SPECIAL—WHILE THEY LAST!

AUDIO COMPUTER 16K RAM pack.....**$37.50**

QSAVE—a hardware/software combination which speeds up loading (16K in 29 seconds).....**$39.95**

VOTEM—3"x4"x1". Analog/digital interface. Measures voltages and temperatures; also includes circuitry that conditions the tape signal for dependable LOADS. Requires no computer modification. Probe provided for temperature measurement (liquid or air).**$60.00**

BOOKS

The Complete Timex/Sinclair Basic Course.....**$35.00**
Understanding Your ZX81 ROM.....**$20.00**
Machine Language Made Simple.....**$20.00**
ZX ROM Disassembly - Part A.....**$15.00**
ZX ROM Disassembly - Part B.....**$15.00**
The Explorer's Guide to the ZX81-
Begins where manual leaves off.....**$15.00**
The ZX81 Pocketbook.....**$17.00**

10% off all books with purchase of 3 or more books.

THURNAL ELECTRONICS

This is a very well built, plug together system.

I/O PORT—4¼"Wx3½"Lx1½"H. Fits between computer and RAM pack (if used). Used to connect controls, sound and music generators, printers, floppy discs, light pens, data transmission, etc. 16 fully programmable input/output lines which are divided into two 8 line ports. May be used without knowledge of electronics or machine code programming. ***Full instructions provided.***.....**$34.00**

MOTHERBOARD—3¼"Wx6¼"Lx⁷/₈"H. Plugs on the I/O port. Used for multiple add-ons. Can handle up to 16 lines.....**$30.00**

JOYSTICK—4"Wx4"Lx6"H. With fire button. Plugs into I/O port or motherboard. 2 joysticks can be used with fire button or 4 joysticks without fire button. Full instructions, programming notes and a game are supplied.....**$25.50**

4 CHANNEL RELAY BOX.....**$27.00**

TRANSISTOR DRIVERS.....**$18.00**

10% Off if 3 or more Thurnal Units are ordered.

MEMOTECH

MEMOPAK.....**16K $55.00; 32K $95.00 64K $170.00**

MEMOPAK RS232 INTERFACE.....**$139.95**

MEMOPAK HIGH RES. GRAPHICS.....**$149.50**
MEMOPAK CENTRONICS PARALLEL INTERFACE.....**$99.95**
PRINTER CONNECTING CABLE.....**$20.00**

SEIKOSHA GP-100 PRINTER—16"Wx9"Dx5½"H. 5x7 dot matrix impact. ASCII standard upper/lower case 30 char/sec, 80 char. wide. Uses standard 9½" fanfold paper. Similar to Radio Shack DMP-100. Requires Printer Interface & Cable.....**$345.00**

PACKAGE DEAL:
GP100 with Memopak Interface and cable.....**$445.00**
$10 shipping for printers in continental U.S. $15 for Hawaii, Alaska and Canada. 10% off Memotech RAM Packs if bought with at least $100 of other products.

SOFTWARE

3D MONSTER MAZE—Superb machine code program with the finest graphics yet produced on the Timex/Sinclair. The 3D effect and monster are well done.....**$14.95**

3D ORBITER—Machine Code, 3 dimensional game.....**$14.95**

PERSONAL BANKING SYSTEM—England's best rated banking program, very comprehensive, machine code allows saving or loading of files in only 45 seconds. Detailed manual included. An excellent program.....**$20.00**

ZX AD—Assembler/Debugger for writing and editing machine code. Outstanding documentation.....**$15.00**

KRAKIT™—win $20,000 or more. List price $19.95.....**$15.00**
ZX GALAXIA—Rated "Best" version.....**$15.00**

ZX SCRAMBLE—Battle aliens.....**$15.00**

INVADERS—Defend your base.....**$15.00**

UNIVERSAL INVENTORY FILE—150 file DBN system.....**$16.00**

PERSONAL RECORDS STORAGE SYSTEM—DBNS.....**$30.00**

BUSINESS PAC I—Break even, cash flow, depreciaton, internal rate of return.

BUSINESS PAC II—Project scheduler—Project Proposal

UNIVERSAL MAILING LIST—Up to 100 names.....**$12.00**

AROUND EUROPE IN 80 HOURS—An unusual program.**$15.00**

10% off with purchase of 3 or more programs.

SEND FOR OUR CATALOG

Free in U.S. — $1.00 for S&H outside U.S.

If you produce QUALITY hardware or software or if you are a dealer, we'd like to hear from you.

All hardware and software guaranteed. We will replace if there are any defects. All prices are U.S. dollars. Add $1.50 for shipping 3rd class, continental U.S. $2.50 for first class, Hawaii, Alaska and Canada (except printers). Washington residents add 6.5% tax.

The Magazine for Sinclair users and Timex/Sinclair users

SYNC

March/April 1983 Volume 3, Number 2

DEPARTMENTS

4 **Letters**

6 **SYNC Notes** ..... *Grosjean*

10 **Glitchoidz Report**

11 **Read This First**

84 **Just for Fun** ..... *Chaiet, Herriott, Hollandsworth, Osborn, Ton*

92 **Resources**

96 **Index to Advertisers**

SYNC ON THE JOB

12 **Using the Byte Back BB-1 and ZX81 as a Control Device** ..... *Potter and Nicholls*
For the scientist

14 **Adding Feet and Inches** ..... *Puterbaugh*
For the builder

18 **Managing with the ZX81** ..... *Coffin*
For the business manager

22 **Archaeological Research Using the ZX81** ..... *Castillos*
For the researcher

28 **A Small Business Payroll Program** ..... *Pattison*
For the accounting department

34 **Macro Photo** ..... *Giannavola*
For the photographer

36 **The Sinclair Grade Book** ..... *Brown*
For the teacher

42 **Knowing Your Strengths** ..... *Crossman*
For the engineer

74 **Math Support from Your ZX81** ..... *Fowkes*
For the math student

PROGRAMMING TIPS AND TECHNIQUES

72 **Deleting Blocks of Basic Statements** ..... *Kraska*
Using NXTLIN

MATH

50 **Understanding Number Systems** ..... *Avoli*
Decimal, octal, hexadecimal, binary

MACHINE LANGUAGE

54 **Looping the Loop** ..... *Doakes*
Beginner's machine language series, part 2

60 **Machine Language Storage in REM** ..... *Kump*
Expanding your REM lines

HARDWARE

62 **System Expansion Hardware** ..... *Trelease*
Keyboard/System Conversion, part 2

68 **A Regulated-Voltage Power Adapter** ..... *Hartung*
A power module

GAMES

76 **ZX Maze** ..... *Thomas B. Woods*
Interactive graphics by display mapping

80 **Minotaur** ..... *Nachbaur*
Escape the labyrinth

REVIEWS

70 **8K Non-Volatile Memory Kit** ..... *Hoffman*
Hardware/software review

71 **Flight Simulation** ..... *Weigt*
Software review

Staff

Founder/Editor-in-Chief ..... **David Ahl**
Managing Editor ..... **Paul Grosjean**
Contributing Editor ..... **David Ornstein**
U.K. Correspondent ..... **Martin Wren-Hilton**
Art Director ..... **Pat Calkins**
Assistant Art Director ..... **Diana Negri Rudio**
Typesetters ..... **Karen Brown**
..... **Renea Cole**
Operations Manager ..... **William L. Baumann**
Personnel and Finance ..... **Patricia Kennelly**
Fulfillment ..... **Frances Miskovich**
..... **Carol Vita**
Advertising Sales Manager ..... **Karen Musmeci**

MEMBER MITA

Volume 3, Number 2

SYNC (USPS: 585-490; ISSN: 0279-5701) is published bi-monthly by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice-President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. 39 E. Hanover Ave., Morris Plains, NJ 07950. Second class postage paid at New York, NY 10001 and at additional mailing offices.

Subscription rates: USA: One year (6 issues), $16; two years (12 issues), $30; three years (18 issues), $42. Canada: $3 per year additional. Other foreign: $5 per year additional.

For *SYNC* advertising information, contact Karen Musmeci, *SYNC* Advertising Sales Manager, Ziff-Davis Publishing Company, One Park Ave., New York, NY 10016 (phone: 212/725-4216).

All other correspondence should be addressed to: *SYNC*, 39 E. Hanover Ave., Morris Plains, NJ 07950. In U.K. to: *SYNC*, 27 Andrew Close, Stoke Golding, Nuneaton CV13 6EL.

Postmaster: Send address changes to: *SYNC*, PO Box 789-M, Morristown, NJ 07960.

© Copyright 1983 by AHL Computing Inc.

Cover illustration by **Burrell Dickey**. Photograph by **Dennis Bettencourt**.

letters

Mouthful

Dear Editor:

Don Day's "A Mouthful for Every Occasion" (*SYNC* 2:5) can be made to run in 8K ROM/1K RAM without decreasing the size or number of words.

The program below uses a three-dimensional string array at line 30 as the method. This is not mentioned in the manual (at least the first US edition).

To use the program, type in the lines. Then use GOTO 20 and ENTER. Next input one of Don's tables. Press ENTER after each word. Each entry may be up to 10 characters long. You do not have to add spaces to fill out the array; the ZX81 does it for you.

```
  10 GOTO 100
  20 FAST
  30 DIM A$(5,3,10)
  40 FOR Y=1 TO 3
  50 FOR X=1 TO 5
  60 INPUT P$
  70 LET A$(X,Y)=P$
  80 NEXT X
  90 NEXT Y
 100 SLOW
 110 PRINT "PRESS ENTER TO GENER
ATE PHRASE"
 120 INPUT B$
 130 CLS
 140 PRINT AT 10,0;""
 150 FOR X=1 TO 3
 160 PRINT A$(INT (RND*5)+1,X);"
 ";
 170 NEXT X
 180 PRINT AT 15,0;"AGAIN? (Y/N)
"
 190 PAUSE 10000
 200 IF INKEY$="Y" THEN GOTO 130
 210 STOP
```

After entering your list, SAVE the program. Then use GOTO 10 and ENTER to begin or you will lose your list.

Charles Godwin
3830 San Simeon Ave.
Oxnard, CA 93033

Draw and Store

Dear Editor:

The following changes in J. J. Hollandsworth's excellent "Draw and Store" routine (*SYNC* 2:6) permit SAVEing the display on tape in 1K RAM. The stored picture is displayed almost instantly upon reLOADing from tape. Note that all underlined words in the PRINT statements are token words to conserve RAM.

```
   1 REM HARTUNG
   5 CLS
 500 PRINT AT 21,0;"KEY ENTER  I
Q SAVE "
 510 PAUSE 40000
 520 IF CODE INKEY$=118 THEN SAV
E "DRAW"
 530 PRINT AT 21,0;" INPUT NEW P
LOT ? Y OR N"
 540 PAUSE 40000
 550 IF INKEY$="Y" THEN RUN
 560 GOTO 540
```

Enter lines 10 through 80 of the original listing, then enter the lines below.

Notes:

510: POKE 16437,255 is not required here or at line 30 with the improved 8K ROM.

550: Start the recorder, then key ENTER twice to SAVE to tape.

Robert Hartung
PO Box 125
Palmyra, NY 14522

Rounding Off

Dear Editor:

James E. Stauffer's article "Rounding off with Conditional Tests" in *SYNC* 2:4 could be expanded to show how problems could be reduced and performance improved by a change in the methods used. The program below suggests some possibilities in this direction.

I used a table of squares to save multiplication, set the loop limits to remove unworkable cases, and substituted additional for multiplication. Then I developed algebraically a method that directly generates only the "Pythagorean Triples." An efficient method from Euclid computes the greatest common divisor to eliminate triples that are multiples of smaller triples. Since I prefer right-justified numbers, I used a different method of tabulating the answers. Lastly, I deferred computing the third component of each triple until I had decided to format and print the triple.

```
  10 DIM S(20)
  20 FOR N=1 TO 20
  30 LET S(N)=N*N
  40 NEXT N
  50 FOR N=1 TO 19
  60 LET N2=S(N)
  70 FOR M=N+1 TO 20
  80 LET M2=S(M)
  90 LET A=M2-N2
 100 LET B=M*N
 110 LET B=B+B
 120 IF A<=B THEN GOTO 160
 130 LET X=A
 140 LET A=B
 150 LET B=X
 160 LET DN=B
 170 LET DR=A
 180 LET R=DN-INT (DN/DR)*DR
 190 IF NOT R THEN GOTO 230
 200 LET DN=DR
 210 LET DR=R
 220 GOTO 160
 230 IF DR<>1 THEN GOTO 250
 240 LET A$=STR$ A
 250 LET B$=STR$ B
 260 LET C$=STR$ (M2+N2)
 270 PRINT TAB (5-LEN A$);A$;TAB
 (12-LEN B$);B$;TAB (18-LEN C$);
C$;
 280 NEXT M
 290 NEXT N
```

The line notes are:

20-30: Save table of squares.

50: Adjusted loop limits.

60: Operation moved to outer loop.

70: Adjusted loop limits.

90-110: "Direct method." A = M ** 2 - N ** 2. B = 2 * M * N. C = M ** 2 + N ** 2.

130-150: Conditional swap of A and B values to make A the smaller and B the larger.

160-220: Euclid's method for GCD.

230: Skip multiples.

240-270: Right-justified numbers.

The program runs on the T/S 1000 without additional memory.

Randolph J. Herber
1123 B Bunker Hill Ct.
Wheaton, IL 60187

Ed.—For 1K RAM, RUN in FAST. When the display stops with error code 4, hit CONT and ENTER. For more than 1K add:

265 SCROLL and RUN in SLOW.

DON'T TAKE OUR WORD FOR IT... READ THE REVIEWS:

GAMESTAPE 1
GAMESTAPE 1 with 11 great games for your standard TS1000/ZX81 has achieved to fit into the standard machine what others require 16K to do! Games ranging from arcade games and word games right through to an amazing machine code wallbusters game! "I was very impressed with the amount which had been packed into the standard machine" – ZX Computing. "The wallbusters game is the best TS1000/ZX81 version of this game I have seen" – Which Micro.

GAMESTAPE 2
GAMESTAPE 2 brings you three great programs for the TS1000/ZX81 with 16K: STARFIGHTER – a superb machine code space battle, with twinkling stars and stunning explosions! PYRAMID – a thinker's game; ARTIST – the ultimate graphic designer's aid.
"The gamestapes are a fine range of software. All programs ran the first time with no bugs. All can be recommended" – Which Micro?
"Good value for money"
– Computer & Video Games.

GAMESTAPE 3 – CATACOMBS
GAMESTAPE 3 for 16K TS1000/ZX81 is a multi-level graphics adventure that is not limited in its scope. Each level can contain up to 9 rooms, 8 passages, as well as monsters, food, gold, traps, phantoms . . . "An excellent addictive game which will keep you amused for hours" – Computer & Video Games.

GAMESTAPE 4 – 3D MONSTER MAZE
GAMESTAPE 4 for 16K TS1000/ZX81 is the game to top all the others! Unbelievable graphics! Can you find your way through the 3D Monster Maze, with a T. Rex chasing after you? You've never seen anything like this! "If I had to choose just one program to impress an audience with the capabilities of the TS1000/ZX81, then 3D Monster Maze would be the one" – ZX COMPUTING "3D Monster Maze is the best game I have seen for the ZX81" – Computer & Video Games "The graphics are superb" – Which Micro? "Brilliant, brilliant, brilliant!" – Popular Computing Weekly.

GAMESTAPE 5 – 3D ORBITER
GAMESTAPE 5 for the 16K TS1000/ZX81 is the ultimate space game! In amazing 3D graphics, you battle against marauding invaders. Using the keyboard like a joystick, you can climb, bank and dive in 3D, as the ground slips past and the bad guys prepare to attack. "Amazing graphics effects are created as the enemy draws closer, more and more detail appearing as the flying saucers zoom in. Another winner!" – Sinclair User "The best way I can sum up this game is 'GREAT'!" – ZX COMPUTING.

Plus award winning books

UNDERSTANDING YOUR ZX81 ROM
by Dr. Ian Logan "SYNC readers will recognize Dr. Logan as a major ZX80/81 expert whose writings are well worthwile. *Understanding Your ZX81 ROM* is no exception."

MACHINE LANGUAGE PROGRAMMING MADE SIMPLE *SYNTAX* wrote: "It's the best explanation of Machine Language for Machine Language beginners I've seen."

Orders to: **MELBOURNE HOUSE SOFTWARE INC.**
Dept. CS 347 Reedwood Drive, Nashville, TN 37217

Visa and M/C orders can be phoned in: 615/361-3738

Dealer orders and queries: 800/251-5900 (ask for a Melbourne House operator)

New prices

TAPES:

☐	13941	Gamestape 1: 11 Programs-1K	$14.95
☐	13942	Gamestape 2: 3 Games-16K	$14.95
☐	13943	Gamestape 3: Catacombs Adventure-16K	$14.95
☐	13944	Gamestape 4: 3D Monster Maze-16K	$14.95
☐	13945	Gamestape 5: 3D Orbiter-16K	$14.95
☐	26446	Space Trek-16K	$14.95
☐	26359	Super Invasion-1K	$14.95
☐	26318	Wall Busters-1K	$14.95
☐	26472	10 Exciting Programs-1K	$14.95
☐	26284	Reversi-1K	$14.95
☐	26406	Toolbox-1K	$14.95
☐	26490	Basic Course 2 cassette pack	$7.50
☐	14026	Combat Flight-16K	$14.95

BOOKS:

☐	25895	The Complete Basic Course	$34.50
☐	25957	Machine Language Programming Made Simple	$14.95
☐	20922	The Complete Timex/Sinclair ROM Disassembly	$19.95
☐	26025	Not Only 30 Programs	$9.95
☐	25913	Understanding Your ZX81 ROM	$14.95

TOTAL: $_____

Residents of CA, MD, TN, please add sales taxes: _____

Add $2 for Shipping & Handling, foreign orders add $6: _____

TOTAL: $_____

Enclosed is my check or money order for $_____

Please charge my ☐ Visa or ☐ MasterCard Card # _____ expiration date _____ SYNC2

Signature _____ Name _____

Address _____ City _____ State _____ Zip _____

MELBOURNE HOUSE SOFTWARE

THE ZX COMPILER

generates a machine code program from one written in an integer subset of Timex/Sinclar Basic

commands/functions

DIM
FOR/NEXT
LET
IF/THEN
GOTO
GOSUB/RETURN
PRINT
LPRINT
PLOT/UNPLOT
POKE
STOP
FAST
SLOW
PAUSE
RAND
CLS
COPY
SCROLL
AND, OR
NOT
ABS
SGN
USR
RND
PEEK
INKEY$
MOD(**)
AT & TAB

-256 variables (two letter)
-26 single DIM arrays
-16 bit arithemetic
-PRINT & INPUT in hex or decimal
-modulus function
-includes REM generator & code move routines
-hi and lo memory versions (28-32k & 12-16k)

results:
program speed close to hand coded. program size ⅔-¾ original

both versions on one cassette **25.00** (new price)

THE ZX ASSEMBLER & DISASSEMBLER

now all machine code.

Assembler resides 26-32k, Disassembler 24-26k

Allows hex or decimal constants, labels, origin, data & comments, source code in REM statements, object code anywhere.

15.00 (cassette)

THE ZX SERIAL PRINTER INTERFACE

plans and listing

RS-232 ASC II output thru MIC port. hardware cost about $10—236 bytes of machine code prints, characters, strings & listings.

5.00

Bob Berch
19 Jaques St.
Rochester, N.Y. 14620

all prices include shipping • NYS residents add 7% tax

sync notes

Paul Grosjean

The Timex/Sinclair 2000

The two questions we hear most frequently are: When will the Spectrum be available? When will the printer be available? At the Consumer Electronics Show in Las Vegas, January 6-9, Timex announced that the Timex/Sinclair 2000 computer will be available to retailers beginning in the second quarter of this year. The T/S 2000 is described as a "redesigned and enhanced version" of the Spectrum (see *SYNC* 2:4 for an extensive discussion of the Spectrum). It will be available in a 16K model for $149.95 and in a 48K model for $199.95.

Timex also announced that the Timex/Sinclair 2040 thermal printer will be available in January for $99.95 for use with any Timex computer. A dot matrix print mechanism with a speed of two lines per second is incorporated. The printer will provide 32 columns, complete graphics and text capability, and two different modes: full screen and program controlled to give custom control of the printing format. (See photo on page 8 on these items.)

Consumers who purchase the T/S 1000 between January 15, 1983, and March 31, 1983, will be able to participate in a rebate program. A coupon obtained from the dealer along with a dated proof of purchase will get a $15 rebate from Timex.

In addition to the standard cassette software using cassette tape recorders, users of the T/S 2000 will be able to use a new type of solid state software in the form of minidiskettes which will plug directly into the computer. No recorder is needed.

SYNC on the Job

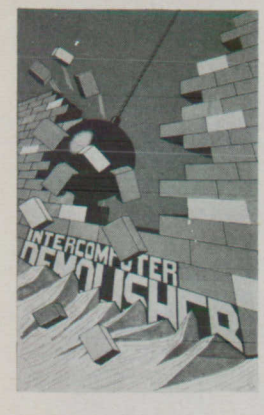
The theme section in this issue is "SYNC on the Job." We have included nine articles which illustrate a few of the ways that people in widely differing fields can use the Sinclair computers for their work. In some cases the computer is a handy tool; in others it seems to have become almost indispensable. Some users are taking advantage of the computer's ability to control external devices; others, its ability to control data—to store, manipulate, interpret, and display. As a result, the user either saves time or has information available that would be difficult, if not impossible, to have otherwise.

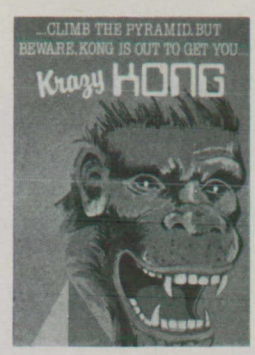
While many of you may not be able to use the programs directly in your work, we hope that one of them will come close or give an illustration of a program that can be adapted to your particular situation.

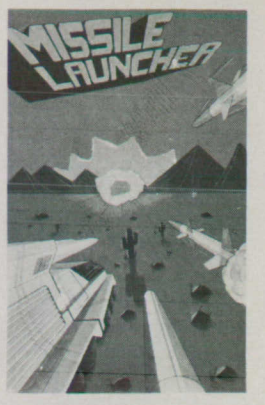
We will welcome hearing from you about how you are using this computer in your work.

Next Issue

Our May/June issue will be a Buyers Guide. We are inviting suppliers of products for the Sinclair and Timex/Sinclair computers to submit brief product descriptions (60 words maximum) of all their products. The deadline for submission is March 1.







IC INTERCOMPUTER INC.

T.M.

HARDWARE AND SOFTWARE PACKAGES MAKE THE MOST OF YOUR TIMEX SINCLAIR 1000

MEMOTECH PERIPHERALS

MEMORY EXPANSIONS

- 16K RAM # PL7002 $ 59.95
- 32K RAM # PL7003 $109.95
- 64K RAM # PL7004 $179.95
- **HIGH RESOLUTION GRAPHICS** (16K RAM) # PL7007 $144.95
- **PLUG-IN KEY BOARD** # PL7011 $99.95
- **CENTRONICS PARALLEL INTERFACE** # PL7005 $104.95
- **MEMOTECH RS232 INTERFACE** # PL7006 $139.95

PRINTERS

- **SEIKOSHA GP-100A PRINTER** The revolutionary low-cost dot matrix impact printer—Uses up to 9.5" paper # PL7008 $349.00
- **SEIKOSHA GP-250X PRINTER** The most intelligent programmable graphic printer—Uses up to 9.5" paper # PL7009 $449.00
- **PRINTER-INTERFACE CABLE** # PL7010 $19.95
- **MEMOCALC** Software on plug-in EPROM cartridge—Spread sheet analysis—Up to 7000 numbers (when used with 64K) # BS200C $59.95

EDUCATIONAL ADVENTURE SERIES

- **EDUVENTURE I** Answer the questions encountered in each classroom until you make it outside for RECESS and the surprise that awaits you there. (Grade level K-3) # ED3001 $12.95
- **EDUVENTURE II** Each new situation requires either your ingenuity or knowledge (or both) to avoid being sent to the principal's office. (Grade level 4-6) # ED3002 $12.95
- **EDUVENTURE III** Solve complex puzzles to outwit your teacher and achieve the highest scores. (Grade level 7-9) # ED3003 $12.95
- **EDUVENTURE IV** An agile mind and quick reflexes will get you through this maze of mysterious situations-to your DIPLOMA. (Grade level 10-12) # ED3004 $12.95

All programs use 16K RAM.

NEW products coming soon: Software on **ROM/EPROM CARTRIDGES—SOFTBOX™**. A software library which can contain several ROM/EPROM programs. Plug in your computer and instantly call any program from your SOFTBOX™— A full line of software and peripherals for the colorful **ZX SPECTRUM/TIMEX SINCLAIR 2000.**

For more information, **Free Brochure,** and Special Package Discount, write or call:

IC INTERCOMPUTER INC.
O. Box 90, Prudential Center
ston, MA 02199 Tel: (617) 437-1190
ex: 951141 COFAR

QSAVE A Hardware-Software Combination—Allows a baud rate of 4000 to be achieved compared with only 250 on the normal SINCLAIR ZX81—Loads and saves a full 16K in only 29 seconds—Works with 16K and 64K. # PL7001 $37.95

Dealers and Distributors Inquiries Welcome

Mail to: Intercomputer, Inc., P.O. Box 90, Prudential Center, Boston, MA 02199

PART #	QTY.	UNIT U.S. $	TOTAL
Shipping and Handling Printer		9.95	
Shipping and Handling Memotech Products and QSAVE		4.95	
Mass. Residents Tax		5%	
		Total	

☐ Check ☐ Mastercard ☐ Visa

Account No. _____ Exp. _____

Name _____

Address _____

City _____ State _____ Zip _____

HOME MANAGEMENT

- **BILL ORGANIZER** Keeps track of bills, amounts due, date due, finance charges, payments made, etc. Summarizes all data for tax purposes. # HM5001 $14.95
- **CHECK BOOK** Balances and maintains your checkbook. Finds all checks written to one payee easily. Add a printer and it will even write checks for you. # HM5002 $14.95
- **ADDRESS BOOK** Store, update and retrieve names, addresses, and phone numbers. With a printer attached, it will print mailing labels, sorts entries alphabetically by name, or by Zip Code. Only remember part of a name? It will find records from incomplete information. Code the entries for special purposes, i.e. Christmas Cards, Party Invitations, etc. # HM5003 $14.95
- **OCCASION CALENDAR** Keep track of birthdays, anniversaries, meetings and special events. Have your calendar appear on the screen at the touch of a key. # HM5004 $14.95

All programs use 16K RAM.

ENTERTAINMENT

- **MISSILE LAUNCHER** Challenge the enemy by destroying his ammunition stored in different locations. # FG1002 $12.95
- **KRAZY KONG** A new version of the popular arcade game. This program has all the features of the original and is every bit as fast. # FG1013 $12.95
- **GHOST HUNT** Gobble your way through a maze of Ghosts, Power Pills, etc., etc., very fast. # FG1014 $12.95
- **MAZE DRAG RACE** Drive through a giant maze 9 times the size of the screen, watch out for other cars, rocks, oil and ice. A really superb machine code game. # FG1015 $12.95
- **DEMOLISHER** Design an intelligent strategy to demolish a growing wall before it crushes you. # FG1005 $12.95
- **MCODER** Compiles a BASIC program into machine code—Extremely simple to use—Write and debug your Basic programs—Enter the MCODER—the Basic program will be compiled into machine code as you watch. # PT4001 $18.95
- **RETURN FROM SPACE** # FG1001 $12.95
- **JEOPARDY** # FG1003 $12.95
- **VEGAS** # FG1004 $12.95
- **AIR ATTACK** # FG1006 $12.95
- **GUARD THE PRESIDENT** # FG1007 $12.95
- **SUBMARINE** # FG1011 $12.95
- **COMBO PACK I** Contains Return From Space and Missile Launcher # FG1008 $18.95
- **COMBO PACK II** Contains Vegas and Jeopardy # FG1009 $18.95
- **COMBO PACK III** Contains Demolisher and Air Attack # FG1010 $18.95
- **COMBO PACK IV** Contains Guard The President and Submarine # FG1012 $18.95

All programs use 16K RAM.

Limited warranty—Defective Software will be replaced if returned within 30 days.—Memotech Products: 180 days—Seikosha Printer: 90 days

The Timex/Sinclair 1000 and 2000 computers, the 16K RAM pack, the Timex/Sinclair 2040 Printer, and assorted software.

LIMITLESS EXPANSION FOR SINCLAIR/TIMEX

FLOPPY DISC INTERFACE $179 **1-4 DRIVES, ANY SIZE *SINGLE/DOUBLE DENSITY *INDUSTRY STANDARD IBM FORMAT *ON BOARD DOS IN ROM RIBBON CABLE CONNECTIONS FOR MAXIMUM RELIABILITY 1000 TIMES FASTER THAN CASSETTE*

5.25" DOUBLE DENSITY FLOPPY DISC DRIVES $189 *EA.*

POWER AND CABLES FOR 2 DRIVES $69 FOR 4 DRIVES $79

STD BUS INTERFACE $99 *COMPLETE WITH RIBBON CABLE CHOOSE FROM 300 PERIPHERAL INTERFACES, 60 MANUFACTURERS*

CENTRONICS PRINTER INTERFACE $119 *COMPLETE WITH PRINTER CABLE, SOFTWARE IN ROM*

DIRECT VIDEO MODIFICATION $25 *WE INSTALL* **$15** *YOU INSTALL*

WORD PROCESSING SOFTWARE PACKAGE $15 *MACHINE LANGUAGE*

AERCO

BOX 18093 AUSTIN
TX 78760-8093
(512) 385-7405

If you own a Timex Sinclair, a ZX81, or any other Sinclair computer, you've probably discovered that the big microcomputer magazines cover only the bigger computers. Where can you find helpful articles on the Sinclair? In *Sync!*

Sync is the one magazine that's written exclusively about Clive Sinclair's marvelous inventions, the Sinclair computers. And it's the one magazine to read if you want to get more from *your* Sinclair.

You'll find program listings for games, helpful programming techniques, hardware upgrades, math and science programs, news of new products for the Sinclair—in short, everything you need to use and enjoy your Sinclair to the fullest.

In just two recent issues, for example, we covered:

- ☐ Putting a Reverse Character in a String
- ☐ How to Double Your Memory
- ☐ Least Squares Data Analysis With the ZX80/81
- ☐ Space Warp: A Graphics Space Game
- ☐ How to Reduce "Blank Screen Time"
- ☐ Storing Three-Letter Words in an Array
- ☐ Software Review: ZX Galaxians
- ☐ An Introduction to Expression Evaluation
- ☐ Short Programs Just for Fun
- ☐ The ZX81 Parser and User-Defined Commands
- ☐ Understanding Floating Point Arithmetic
- ☐ Handling Strings from Another Dimension
- ☐ Book Review: Understanding Your ZX81 ROM
- ☐ How to Add a Keyboard to Your Sinclair
- ☐ Translating Other Basics: DEF on the ZX81
- ☐ Six Outer Space Games—With Program Listings
- ☐ Hardware Review: Sinclair ZX Spectrum High Resolution Color/Sound Computer

If you own a Sinclair microcomputer, *Sync* is the only computer magazine you really need. Subscribe now to *Sync*, and you can save up to 33%! Just complete and return the postage-paid reply card or the coupon at right.

SAVE UP TO 33% ON *SYNC!*

sync

CN 1986 · Morristown, NJ 07960

YES! Please send me *Sync* for:

- ☐ One year (6 issues) for $12.97—I save 19%.
- ☐ Two years (12 issues) for $22.97—I save 28%.
- ☐ Three years (18 issues) for $31.97—I save 33%.

Savings based on full 1-year subscription price of $16.

Mr.
Mrs.
Ms. _____
(please print full name)

4S12

Address _____ Apt. ____

City _____

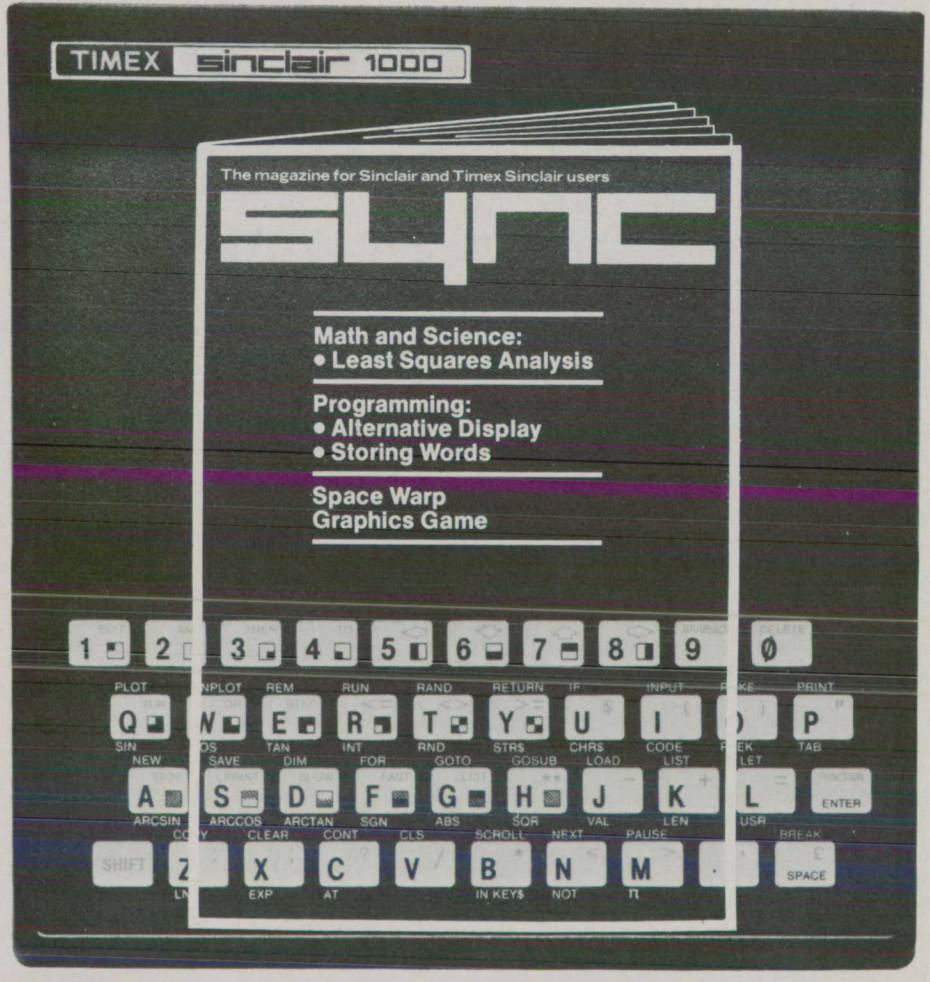
State _____ Zip _____

CHECK ONE:

☐ Payment enclosed. ☐ Bill me later.

Offer valid in U.S. and possessions only. Please allow 60 to 90 days for delivery of first issue.

NEW SUBSCRIBERS ONLY



FOR SINCLAIR AND TIMEX SINCLAIR OWNERS ONLY

LET YOUR ZX81/TIMEX 1000 WORK FOR YOU!

PERSONAL AND BUSINESS PROGRAMS:
Are on cassette, are menu driven, run with or without a printer and save on tape automatically.

SALES FILE 16K:
Will hold up to 150 products with their wholesale and retail prices. — Separates and totals wholesale and retail prices and shows the amount of profit in up to 25 different accounts. — Records inventory automatically or may be changed manually. — Keeps a running total of sales tax. — Has a cash register mode which will identify, total, and add sales tax while it automatically keeps records for your bookkeeping.
If you have a printer you may print a list of products, accounts, your inventory and sales slips.
A must for any small business $19.95

SALES FILE 64K:
Same as above except it will hold up to 600 products for up to 100 accounts.
A must for a larger business. $19.95

CHECKING 16K:
Lists up to 25 deposits showing amount of deposit and date entered. — Lists up to 80 checks and displays check number, date and to whom check was written. Lists by account the total of the checks written to any given account. — Keeps a running total of checks written and the balance left in your account. — Adds interest and subtracts service charges. — Search for a check by check number, name, date or amount to find any check quickly. Prints a list of deposits, accounts, and checks.
Great for tax records. $9.95

INVENTORY (1) 16K:
May be used for everything from keeping an accurate inventory for your business, to your personal record collection. — Holds up to 150 items with comments for each. — Comments may be used for serial numbers, dates, prices or location. — List all items, search for a single item, change or delete any item.
Prints a list of items, quantities and comments.
Everyone should have an inventory of household items in case of fire or theft. $9.95

INVENTORY (1) 64K:
Same as above with up to 750 items. $9.95

INVENTORY (2) 16K:
Same as above without comments.
Holds 300 items. $9.95

CASH REGISTER 16K:
Totals, figures sales tax, clears and keeps daily totals. Prints sales slips.
Turn your ZX81/TIMX 1000 into a cash register 49.95

MAILING LIST 16K:
Holds up to 100 names, addresses and telephone numbers. Search by name, city, zip code, or phone number to find any address or phone number quickly. — Will sort by name, city, or zip code in alphabetical or numerical order. Lists all names, changes or deletes. — Print a list of names or names and addresses. — Print address labels if they are available for your printer.
A valuable tool for your home or business $9.95

MAILING LIST 64K:
Same as above with up to 500 addresses. $9.95

APPOINTMENT CALENDAR 16K:
May be used for everything from reminding you of birthdays to business appointments. — Just enter the date and list up to (8) appointments per day for up to (31) days. Lets you change or delete any appointment. — Print a list of appointments for the day or the month.
Save all appointments on tape.
Keep a permanent record of past appointments $9.95

EDUCATIONAL PROGRAMS:
On cassette, menu driven, and require 16K.

MULTIPLICATION TABLES:
Allows user to choose the multiplier for up to 50 problems. — A large graphic (YES) or (NO) will appear after each problem. — Incorrect problems may be listed, showing your answer and the correct answer.
The fun way to learn $9.95

MATH QUIZ:
Allows user to choose addition, subtraction, division or multiplication for up to 50 problems, with six difficulty levels. — Incorrect problems may be listed with your answer and the correct answer.
Great for home or class room $9.95

FLASH SPELLING:
Enter up to 50 words for your child to learn to spell. You determine how long you want the word to be flashed. Misspelled words may be listed showing your answer and the correct spelling.
Word files may be saved on tape. $9.95

Any three $9.95 tapes for $24.95. Add $1.00 per tape for shipping. Indiana residents add 5% sales tax. Send Cert. Check, M.O., Visa or MasterCard # w/Exp. Date.

Dealer inquiries invited.

VISA

HEATH COMPUTER SERVICES
950 East - 52 SOUTH
GREENTOWN, IN 46936
PHONE 317-628-3130

MasterCard

Glitchoidz Report

A Machine Code Graphics Line-Drawing Subroutine (2:6)
The program should be run in FAST.
Listing 2. The last characters on some of the lines on the right margin did not print in some copies.

```
 80: (
110: )*
210: *
        second line: D+
360: M
```

Renumbering Basic Statements (2:6, p. 80)
Program 1. 9991: PEEK III, not II6.

Random Walks (2:6)
Line 230: Insert ; after (X+1).

Block Transfers: Variables Transfer (2:6, p. 103)
Figure 3. Line 130. (P+54) is referred to incorrectly in the text as P3+4.
Figure 4. Line 40. (P+66) is referred to incorrectly in the text as P3+6).

A Cheap and Simple EPROM Programmer (3:1)
The author asks to have added at the end of the section "How the EPROM Programmer Works," p. 80, the following paragraph:
As designed, the EPROM programmer will not work with 64K memory modules. The reason is that they generate their own ROM C/S signals which would conflict with those generated by the programmer. However, once programmed, the EPROM could be placed into a ROM socket, provided that the pin configuration is compatible or is made compatible. The problem here is that no one EPROM pin assignment scheme exists. To make a "standard" ROM socket compatible with the EPROM, the following modifications to the ROM circuit (not the programmer) are required: traces to pins 18 and 20 should be reversed. The trace to pin 21 should be cut and pin 21 should be tied to Vcc (+5V). (Note: I have reversed the usual assignments of pins 19 and 20 to aid in compatibility.) In all probability, the ROM circuit provided would require such modifications.

Programming the LOAD Command (3:1, p. 50)
The author recommends the substitution of the following for Figure 1. RAMTOP Change:

```
  10 REM 12345678901234567890123
4567890123456789012345678901234 5
  20 LET A$="0100002A0240C600ED4
2220240ED7382402A8240ED42F9545D2
A0440ED42220440ED52444D2A8240ED5
021979722624022854 0C95"
  30 LET X=16516
  40 IF A$="5" THEN STOP
  50 POKE X,16*CODE A$+CODE A$(2
)-476
  60 LET X=X+1
  70 LET A$=A$(3 TO )
  80 GOTO 40
```

After entering these lines, type RUN and ENTER, LIST and ENTER, 70 and ENTER, 80 and ENTER. Then add the following lines:

```
  15 LET RAMTOP=PEEK 16388+256*P
EEK 16389
  18 REM NEW RAMTOP=32580
  20 LET SHIFT=RAMTOP-32580
  23 IF SHIFT<=0 THEN GOTO 40
  25 POKE 16517,SHIFT-256*INT (S
HIFT/256)
  30 POKE 16518,INT (SHIFT/256)
  35 RAND USR 16516
  40 LOAD "LSCROLL"
  45 STOP
  50 SAVE "TEST LSCROLL"
  60 GOTO 10
```

Read This First

Before entering the programs in this issue, readers should note the following:

The **ROM** and **RAM** requirements for using a given program are shown at the top of the first page of the article. *Observe these carefully.*

NEWLINE and **ENTER** are used interchangeably.

A letter after a number shows the type: b for binary; d for decimal; h for hexadecimal.

In PRINT statements:

: Enter a necessary space.

A (32): Use the graphic character on the A key 32 times. The underline means use the graphic on that key.

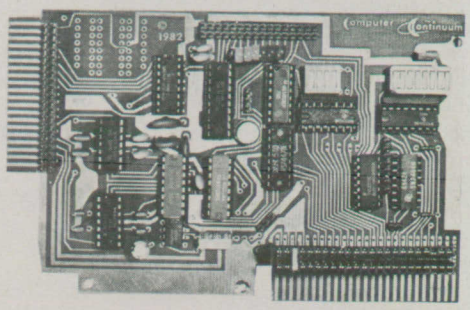
Ā: The overline means use the key in inverse.

INPUT: An underlined *word* found on the keyboard should be entered from the keyboard, not spelled out. If the keyword will not ENTER, hit THEN, the keyword you want, backspace and delete THEN, continue entering the line. This memory saving technique may be disregarded if you have enough RAM.

new **ANALOG** INTERFACE BOARD
8 channels A to D + D to A

fast 1.6 µs A/D CONVERSION TIME. 8 BIT RESOLUTION. 100 NS ACQUISITION WINDOW.

8 CONTINUOUS ANALOG OUTPUTS
0-2.56V OR 0-5V FULL SCALE.
8 ANALOG INPUTS 0-5V.
ADDRESS PICKS CHANNEL.
DIP SWITCHES SELECT MEMORY OR I/O MAPPING AS WELL AS WHICH BLOCK OF ADDRESSES ARE USED.
CAN USE ZX POWER SUPPLY.
UNIQUE DESIGN ALLOWS EASY INTERFACING TO ANY Z80 CPU TYPE MICROCOMPUTER AND OTHERS.
MANY MOUNTING OPTIONS TO ZX81.
FINEST BOARD. NEWEST CHIPS.
KIT $180. ASSEMBLED & TESTED $230.

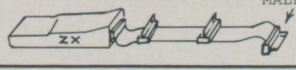


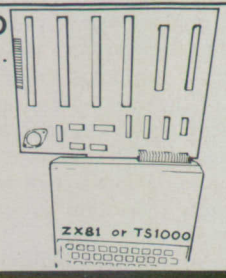
SOFTWARE EXCHANGE. OUR FLYER WILL MARKET OR FREELY ANNOUNCE YOUR PROGRAM OR APPLICATION.

BUFFERED BUS / DEVELOPMENT BOARD
KIT $65. Bare Board $40 W/CONNECTOR & MANUAL.

UHF Modulator RIDS VIDEO INTERFERENCE. REPLACES VHF MODULATOR. **$15**

CONNECTORS FOR 50 WIRE RIBBON. FEMALE TO ZX $7. MALE TO PERIPHERALS $7. GOLD PLATED. ELIMINATES VIBRATION PROBLEMS. USE BOTH CONNECTORS TO AVOID ROW INVERSION PROBLEMS.





TERMS $3 MINIMUM SHIPPING CHARGE. CAL RES ADD 6.5% TAX. PLEASE SEND STAMP FOR MORE INFO. TO ORDER SEND CHECK OR M.O. OR CALL FOR COD. PRICES SUBJECT TO CHANGE.

Computer Continuum
301 16th Ave
San Francisco, CA 94118 (415) 752 6294

PROFESSIONAL KEYBOARD

Timex Sinclair 1000 Sinclair ZX-81

Enter programs and data with accuracy and speed. Individual keypads provide needed tactile feedback. Enables touch typing. 47 keys, six of which are for future use. Space bar. ZX/TS key legends.

This is a completely assembled keyboard, specifically designed for ZX/TS computers. It plugs into the ZX/TS in minutes. No soldering required.

An optional enclosure attractively packages your keyboard and will also house the ZX/TS circuit board. All connections (power, tape, TV and expansion port for 16K RAM, etc.) are easily accessible.

We are so confident that you will enjoy using our professional keyboard that we offer an unconditional money back guarantee. If you are not completely satisfied, simply return it within 10 days and receive a full refund.

Order your keyboard today by sending check or money order to:

THE FULL SPECTRUM
3829 Mainsail Circle
Westlake Village, CA 91361

Keyboard	US$69.95	Shipping/Handling	$4.95
Enclosure	29.95	Calif. Res. add 6½% tax	

GameMaster™

A NEW CONTROL SYSTEM FOR ROLE-PLAYING FANTASY ADVENTURE GAMES*

- Compatible with Dungeons & Dragons® ** Basic Games
- User Friendly

If you enjoy role-playing games, but find the dice-rolling and record keeping a drag, let your **ZX81** or **TS1000** take over these chores. **GameMaster** for 16K RAM lets you create characters and monsters, use them during play, and then save them on tape. It also speeds combat and provides many other features. The 1K and 2K versions provide automated dice rolls, eliminating the need for expensive adventure game dice.

*GameMaster is not a game itself, but an aid to other role-playing games.

**Dungeons & Dragons is a registered trademark of TSR Hobbies, Inc. GameMaster is not associated with TSR Hobbies, Inc.

McKelvie Programs
P.O. Box 53076
Phila., PA 19105

Specify: **16K RAM @$14.95** ____
1K RAM @$6.95 ____
2K RAM @$6.95 ____

PA res. add 6% sales tax (Overseas add $1)

Check☐ MC☐ VISA☐ Card # _____

Exp. Date _____ **Signature** _____

Name _____

Address _____

Using the Byte-Back BB-1 and the ZX81 as a Control Device

Randall M. Potter and Richard J. Nicholls

The precise timing and sequencing of events is of paramount importance in the laboratory of an experimental psychologist. These events often consist of the controlled presentation of some stimulus to one or more of the five senses (most often the stimulus will be visual or auditory) and then some measurement of a behavioral change which results.

One simple chain of events consists of presenting a lever (stimulus) to a white rat, allowing the rat to press the lever (behavior), and immediately providing a pellet of food as a reward.

During the course of a training session the rat will press the lever more and more frequently (behavioral change) to obtain food. In the early days of psychology this whole chain of events was controlled by a human observer who would feed the rat whenever it pressed the lever, record the time of the lever press, and prepare for the next press. Humans are quite easily fatigued by such strenuous regimens, however, and devices which would automate the data recording process were soon invented.

One of the first solutions was the use of electromechanical control equipment. This was just what the name suggests, electrically powered equipment which operated by means of mechanical relay closures and rachet systems. Simple logic circuits could be created with combinations of such equipment and quite sophisticated experiments could be conducted if one had access to enough relay gear.

Still, there were difficulties. Most bothersome was that electromechanical equipment was tedious to "program." Relays were wired together to create the necessary logic circuits and the number of connections needed soon became unreasonably large. As many days of work were often required to set up the equipment for a single experiment, researchers were known to become quite possessive of their racks of relay gear. A fast way to lose a friend was to borrow a bit of equipment from the middle of a rack that was not being used at the moment.

A second problem was that the equipment was only slightly more reliable than the human observer, although much more expensive. Relays stick, counters and clocks jam, and faulty connections appear, seemingly out of nowhere. This last is not as unlikely as it might seem, as the connections on this type of equipment were designed to be easily altered. This made rewiring as painless as could be expected, but frequently led to situations where accidental wiring alterations could occur. A careless movement or even the normal operation of the relays could easily break a connection.

Randall M. Potter and Richard J. Nicholls, Department of Psychology, Clarion State College, Clarion, PA 16214.

A final problem was inherent in the electromechanical equipment itself. Relays operate quite slowly while experimental subjects can respond quite quickly. At times the subject would have to learn both the experimental task and the operating limitations of the equipment.

It is little wonder that psychologists were among the first scientists to adopt the use of microcomputers for controlling equipment and collection of data. Fast, tireless, easy to program, and exceptionally accurate, microcomputers provide solutions for many of the traditional problems of the behavioral laboratory. The remaining portion of this article describes a system, based on the ZX81 and the Byte Back BB-1 control module which we use to automate the study of learning in white rats. We find the system to be useful in a variety of situations in our laboratory and, because of its low cost, particularly adaptable to use by students.

A Simple Model of the Learning Process

Much of what we learn can be explained in very simple terms. We are more likely to repeat those behaviors which are rewarded than those which go unrewarded. In addition, we are more likely to use a behavior which has been frequently practised than one which has been used only rarely. In terms of these two facts we can see a close parallel between simple learning situations and those which are more complex.

While there are undeniable differences between a rat's behavior in learning to press a lever for food and our own in learning to write a Basic program, there are also many similarites. Correct behavior is rewarded by food in the one case and a successful run in the other, while incorrect behavior goes unrewarded. Many computers, including the ZX81, go one step farther and adminster a mild punishment, a syntax error, for an incorrect response.

Some psychologists have chosen to study rats rather than humans because studying a simple behavior such as the lever press and using a simple reward such as food may help us better to understand more complex, but conceptually similar learning situations, including human learning.

A generalized learning situation can be easily described. A subject is placed in a conditioning chamber, called a Skinner box after its inventor B. F. Skinner, and is trained to perform a simple task to obtain a reward. The lever press mentioned previously is a good example. The lever causes a feeder to operate, which in turn delivers a small amount of food to the rat as a reward. Rats quickly adapt to this regimen, and most often this pre-training phase is accomplished by the old reliable, but weary, human observer before the experiment actually begins.

In the next phase of training the ZX81 and BB-1 can be put to use. During this phase it is common to train the rat on a reward schedule which requires more effort than the simple one response/one reward situation we have been considering. Some schedules require that the lever be pressed a certain number of times before a reward is given while others require a certain amount of time to ellapse between rewards. While such schedules are difficult to set up using relay control equipment, it is quite easy to manage most any schedule using the ZX81 and a controller such as the BB-1.

The BB-1 plugs directly into the expansion port at the back of the eight inputs and eight outputs. The BB-1 operates by POKEing values into memory locations 32766 and 32767 for output purposes and PEEKing locations 32764 and 32765 to read inputs. Up to eight *independent* inputs and outputs can be selected, and with the addition of user-built external logic up to 256 each of input and output lines may be used. The BB-1 provides a 44 pin card edge connector with which to make external connections.

Laboratory Example and Program Notes

Controlling a conditioning apparatus with the Sinclair ZX81 and the BB-1 is very easily accomplished by connecting

the lever (which is really a double throw microswitch) and pellet feeder (a 24VDC device) to the edge connector of the BB-1. To use the program given in this article, connect the microswitch's common pole to input 22B, which is the ground for the BB-1. Next connect the normally open

Listing 1.

```
 10 REM OPERANT CONTROL PROGRAM
 40 REM FILLER
 60 LET A=PEEK (32765)
 80 IF A=1 THEN GOTO 100
 90 GOTO 60
100 LET A=PEEK (32765)
120 IF A=2 THEN GOTO 140
130 GOTO 100
140 REM FILLER
150 POKE 32766,128
160 PAUSE 3
170 POKE 32766,0
200 GOTO 40
210 STOP
```

pole to input 7B and the normally closed pole to input 4B. For all connections, "A" refers to the component side of the BB-1 and "B" to the circuit side. Finally, connect a 24VDC power supply through outputs 2A and 2B to the pellet feeder. The BB-1 manual provides information, including a schematic and an assembly drawing, to understand the configuration of inputs and outputs for these as well as other relay operations.

The program in Listing 1, which should be run in the FAST mode, is a simple operations program for the system. Each press of the lever will produce a single food pellet reward. Lines 60 through 90 scan the BB-1 input lines for a value of 1. If the animal is not pressing the bar, the program will cycle immediately to the second program loop. If the rat holds the bar down after receiving a pellet, however, this loop prevents the delivery of any more rewards until the lever is released.

Listing 2.

Insert the following lines into Listing 1.

```
 20 PRINT "WHAT NUMBER OF PRESSES?"
 30 INPUT R
 50 FOR C=1 TO R
140 NEXT C
```

Lines 100 through 130 scan the inputs for a value of 2, which indicates that the lever has been pressed, and send the program into the third loop which operates the feeder mechanism. Line 150 closes the relay which operates the feeder, 160 simply holds the relay long enough for the mechanism to operate, and 170 turns the feeder mechanism off. Line 200 returns the program to the first loop.

Since rats will quickly fill up on food pellets if given the opportunity, we can modify the program slightly to require more than one bar press to obtain a food pellet. Listing 2 shows the additions necessary to accomplish this change. Lines 20 and 40 allow the experimenter to choose the number of lever presses necessary to obtain a reward while lines 50 and 140 count bar presses until the required number have occurred. As an example, if the number "4" was input at line 30, the rat would have to press the lever four times before the program would reach line 150 and operate the feeder.

While the ZX81 lacks a real time clock, the insertion of a few lines into the program provides for precise timing of the interval between the delivery of food pellets. Listing 3 shows the necessary additions and changes. The new line 40 simply initializes the timing variable, while lines 70 and 110 increment the value each time the machine goes through one of the holding loops. Line 180 calculates the time in seconds by dividing the count by a constant. The value 92 was arrived at by trial and error and may be slightly different on different machines. It will almost certainly be different with other programs. Once calculated, however, timing constants seem to be quite accurate. Sample runs of this program produce time

Listing 3.

Insert the following lines into Listing 2.

```
 40 LET T=0
 70 LET T=T+1
110 LET T=T+1
180 LET S=T/92
190 PRINT S;"#";
```

values almost perfectly correlating with an external .01 second stopclick. One important consideration in producing consistant time values is to equalize run times for each loop of the program. This program happens to have equivalent loops, but in other situations REM statements may be added to equalize the loops.

In order to keep the memory requirements as small as possible, we chose to use the display file as a storage area for computed time values. If you have more than 1K RAM, it is probably best to dimension a variable to hold output values. In this way data could be SAVEd at the end of a session without having to be copied from the screen.

Control of equipment using the ZX81 and the BB-1 is obviously not limited to the simple situations presented here nor exclusively to laboratory applications. Many control tasks, from laboratory applications to the operation of devices in the home to hobby uses can be accomplished using computer controllers. The ZX81 and BB-1 are an excellent combination, offering flexibility and low cost when used in replacement of older equipment in the laboratory and can provide considerable control options in home or hobby use. ■

SINWARE provides high-quality machine-code programs for the TS1000 or ZX81.

HOT Z

HOT Z is the machine-programming editor, debugger and disassembler that takes the mystery out of assembly language. Over 40 cursor-driven commands give you an interactive system for entering, revising and relocating code. Full-screen listings with your labels let you understand other programs and capture the power of ROM routines for your own programs.

SQ said of **HOT Z**: *"Easily the best machine language debugging package I have ever seen for the ZX81. . . If you program in machine language and need the best tool for the job, buy **HOT Z.**"*

HOT Z is just $19.95 + $2.00 pp on cassette in different versions for 16K or 32K+. Please specify. **NOW ON EPROM** (four 2716's) mapped to the 8-16K block for the Hunter or similar board, **HOT Z-E** is $40.

Z EXTRA

Z EXTRA is a display creator/controller that makes you a master of ZX graphics and displays. No programming is required to create, save, print or display multiple screens of text and graphics. **Z EXTRA** features a full-screen editor, blinking cursors, repeating keys, four write directions, eight plot directions, 4x4 and 8x8 character sizes, and much more.

Z EXTRA's displays provide horizontal or vertical scrolls of multiple screens against a background screen, or timed page flips for simple animation. Screens can be transferred to BASIC strings to save hours of fussy progamming.

Z EXTRA requries a ZX81 or TS1000 with at least 16K of RAM and is especially useful with 64K. Just $19.95 + $2.00 pp on cassette.

SINWARE
BOX 323, DIXON, NM 87527

Adding Feet and Inches

John C. Puterbaugh

Despite all the glamour that has been given to the metric system in the past few years, there are still some areas of endeavor in which the English system shows no sign of being replaced, at least in America. As an engineer working in the building industry, I am involved in one of those. A few of us are lucky enough to still have an old-fashioned calculator filled with cams and levers, but I have spent untold hours with pencil and paper adding feet and inches and eighths. So I have been looking for a way to automate that is simple and cost-effective, and I have found it in the ZX81.

The first requirement for such a program is that it respond quickly enough that the user does not become frustrated waiting for the answer to flash up on the screen. I also wanted the program to be simple and comprehensible, because I want to be able to add to it the ability to do further processing on the dimensions that have been keyed in. It turns out that with a little attention paid to program layout, Basic does the job.

The program assumes the following conventions: dimensions are entered in feet, inches and eighths. Fractions involving sixteenths and beyond are not used. A dimension 12″ or larger is expressed in terms of feet and inchies. For example, 16″ is expressed as 1′4″. However, this last can be changed, as noted later in the article.

The way of entering dimensions is best shown by the examples in Figure 1. Feet are separated from inches by a period. Whole inches and then the fraction are keyed without a hyphen or slash; 5-1/2″ becomes simple .512. If there are no whole inches, only the fraction need be entered. Thus .14 is understood to be 1/4″ (not 14″). If the dimension is to be subtracted, it is preceded by M. (A minus sign could have been used, but minus is a shifted character and therefore less convenient.)

To start the program simply hit RUN; the two double quotation marks with inverse L cursor between will appear to receive the first dimension. As each dimension is entered it will be interpreted and printed on the screen. To see the total hit ENTER (a null string). The total is really a subtotal; it is not cleared,

Figure 1.

ENTER	UNDERSTOOD TO MEAN
3.4	3′4″
4.12	4′0-1/2″
6.10	6′10″
1.738	1′7-3/8″
2.1114	2′11-1/4″
.18	0′0-1/8″
154	154′-0″
M12.6	-12′6″
M.958	-0′9-5/8″

and additional dimensions may be added or subtracted. The total is printed with an asterisk and may be negative. Enter C to clear the total and the screen. To stop the program delete the left double quotation mark and substitute STOP. If Basic stops the program due to faulty input, it may be restarted without losing the total by entering GOTO 140.

Since Basic locates a given line by searching from the top, the subroutines that interpret the dimensions have been placed first so as to minimize the time spent in the search. (RETURN is done directly without a search.) There are also no REM statements to slow things down. The program actually begins at line 110—Line 5 could be eliminated with a very small increase in speed if one remembers to always start with RUN 110. Personally, I have trouble with this, so I have included line 5.

Because of line 310, lines 10, 20, 30 and 40 must have those numbers and no other. Line 150 is the only input instruction in the program. If it is desired to process dimensions in a new program segment, the test for the new instruction should be placed around lines 170 and 180.

Lines 240 through 260 locate the period, if any. If there is no period, then the dimension is all feet and we are ready to print. If a period is found, the feet are placed in X and the feet and period are chopped off the string at line 300. This leaves from 1 to 4 digits remaining.

If there is one digit, it is whole inches 0-9. If there are three digits, they are whole inches 0-9 plus a fraction of two digits. If there are four digits, they are whole inches 10-11 plus a fraction of two digits. If there are two digits, they may be whole inches 10-11 or a fraction with no whole inches. This separation is made at line 20. 10 or 11 will lead to line 10 whereas 18, 14, 38, 12, 58, 34, or 78 will lead to line 21. If it is desired to be able to input numbers of inches larger than 11, then things can be rearranged so that two digits always lead to line 10. In this case, a dimension of 1/2″, for example, will have to be entered .012 which requires an extra keystroke.

RETURNing to line 320, we are now ready to PRINT. Since the ZX81 character set does not include an apostrophe, the graphic on the 1 key has been used instead. I find that this reads very well. The extra PRINT statement at line 350 is required to end the line should there be no fraction; accordingly there is a semicolon at the end of line 80 also. The dimension is added to the total at line 380, and we are ready for the next command.

Line 400 sets W equal to the total and calls the PRINT routine which begins at line 440. This has been made a subroutine so that future program segments can use it to PRINT dimensions in the standard format. To use the subroutine, set W equal to the desired dimension in decimal inches and GOSUB 440. The asterisk could be turned on and off in a string variable if it were not appropriate for all calls to 440.

PRINTing of the fraction associated with the total is done by pointing to the appropriate characters in B$. The

John C. Puterbaugh, 788 Yale Ave., St. Louis, MO 63130.

Hardware Breakthrough!

* **ZX-Man**
$14.95

* **Joystick**
$14.95

* **Keyboard**
$74.95
full-size assembled
w/leatherette case

FULLY ASSEMBLED KEYBOARD

1) Fully assembled
2) Includes Key Cap Legends
3) 30 Day Warranty
4) 2X80/ZX81 compatible
5) Some soldering necessary
6) Timex TS1000 Compatible

THE INNOVATORS ARE COMING

Call or Write for more information

American Express, Visa, Master Charge, Money order, pc (allow 2-3 weeks to clear)
Please add $2.50 postage & handling
Illinois residents please add 5% Ill. sales tax

Visit our Showroom 10:00 - 6:00 Monday thru Saturday

AMERICAN EXPRESS Cards Welcome

VISA

MICROCOMPUTERS PLUS, INC.
349 EAST MAIN ST.
GALESBURG, IL 61401
PHONE: (309) 342-9572

master charge THE INTERBANK CARD

Figure 2.

```
VARIABLES

A$   INPUT STRING
B$   IMAGES OF FRACTIONS
X    FEET
Y    WHOLE INCHES; DECIMAL INCHES
N    NUMERATOR; 4*NUMBER OF EIGHTHS
D    DENOMINATOR
Z    DIMENSION IN INCHES;
     FRACTION EXPRESSED AS DECIMAL
W    LAST DIMENSION DISPLAYED
     (DECIMAL INCHES)
S    SIGN;  0 = +; 1 = -
T    TOTAL (DECIMAL INCHES)
I    COUNTER
```

pointer is generated in line 510. The .1 is added to 32*Z to overcome roundoff error that occurs in the decimal to binary conversions that are going on within Basic. If the .1 is left out, part of the time N will be very slightly less than the correct value, and the wrong characters will be PRINTed in line 520.

The contents of the program variables are shown in Figure 2. After each addition or total, W contains the last PRINTed dimension in decimal inches, and is available for use elsewhere. ■

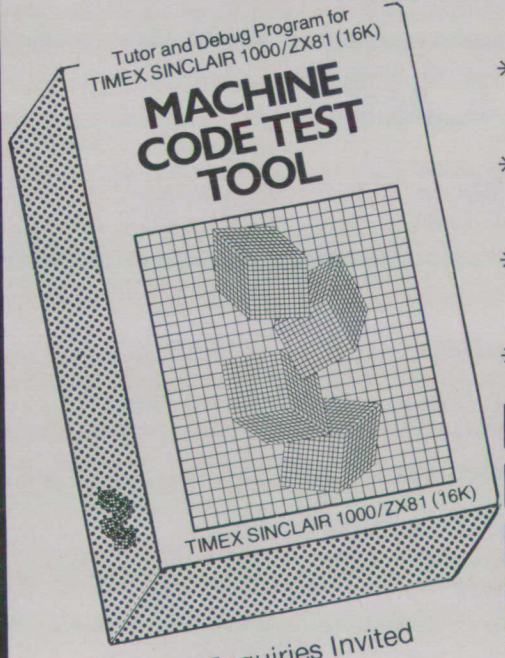
Figure 3.

```
  1 REM ENG
  5 GOTO 110
 10 LET Y=VAL A$
 11 RETURN
 20 IF VAL A$<12 THEN GOTO 10
 21 LET N=VAL A$(1)
 22 LET D=VAL A$(2)
 23 RETURN
 30 LET Y=VAL A$(1)
 31 LET N=VAL A$(2)
 32 LET D=VAL A$(3)
 33 RETURN
 40 LET Y=VAL A$( TO 2)
 41 LET N=VAL A$(3)
 42 LET D=VAL A$(4)
 43 RETURN
 50 LET S=1
 60 LET A$=A$(2 TO )
 70 RETURN
 80 PRINT "-";N;"/";D;
 90 LET Y=Y+N/D
100 RETURN
110 LET B$="-1/8-1/4-3/8-1/2-5/
8-3/4-7/8"
120 LET T=0
130 CLS
140 SLOW
150 INPUT A$
160 FAST
170 IF A$="" THEN GOTO 400
180 IF A$="C" THEN GOTO 120
190 LET S=0
200 IF A$(1)="M" THEN GOSUB 50
210 LET X=0
220 LET Y=0
230 LET N=0
240 FOR I=1 TO LEN A$
250 IF A$(I)="." THEN GOTO 290
260 NEXT I
270 LET X=VAL A$
280 GOTO 320
290 IF I>1 THEN LET X=VAL A$( T
O I-1)
300 LET A$=A$(I+1 TO )
310 GOSUB 10*LEN A$
320 IF S THEN PRINT "-";
330 PRINT X;" ";Y;
340 IF N THEN GOSUB 80
350 PRINT
360 LET W=12*X+Y
370 IF S THEN LET W=-W
380 LET T=T+W
390 GOTO 140
400 LET W=T
420 GOSUB 440
430 GOTO 140
440 LET Z=ABS W
450 LET X=INT (Z/12)
460 LET Y=Z-12*X
470 LET Z=Y-INT Y
480 IF W<0 THEN PRINT "-";
490 PRINT X;" ";INT Y;
500 IF NOT Z THEN GOTO 540
510 LET N=INT (32*Z+.1)
520 PRINT B$(N-3 TO N);" *"
530 RETURN
540 PRINT "     *"
550 RETURN
```

Line notes:

10: Whole inches only.
20: 2 digits to right of period.
21: Fractional inches only.
30: 3 digits: 0-9 inches plus fraction.
40: 4 digits: 10 or 11 inches plus fraction
50: Set up for subtraction.
80: Print fraction.
110: Initialize.
150: Next command.
170: Does user want total?
180: Does user want to clear?
200: Is this a subtraction?
240: Find location of period.
270: No period; whole feet only.
290: Extract feet.
300: Chop off feet and period.
310: Len A$ equals 1, 2, 3, or 4.
330: Graphic on 1.
340: Print fraction if any.
400: Print total.
440: Subroutine to PRINT W.
490: Graphic on 1.
510: PRINT the fraction.
540: No fraction.

At Last Your Chance To Crack The Machine Code



Trade Enquiries Invited

TIMEX 1000 AND ZX81 OWNERS

- If you are interested in finding out how a computer **really** works and want to experience true programming power – the machine Code Test Tool is the answer.
- The Machine Code Test Tool is a utility program which comes complete with tutorial course enabling you to enter, test, display and debug hexadecimal machine codes simply and quickly.
- The Machine Code Test Tool is constructed to help the absolute beginner who wishes to explore this fascinating subject, or the expert keen to polish up his machine code programs.
- A HEX: decimal conversion routine is contained within the program as standard.

Post to: R. L. ASSOCIATES, 614 W. Manchester Blvd., Inglewood, Cal. 90301

Please rush.....ZX81.M.C.T.T. at $19.95 ($25.95 Canada)

Send payment to above address

NAME .....

ADDRESS .....

STATE..... ZIP..... R.L.I.

Britain's leading Software house means ONCE BITTEN...
ADVENTURES:
Dictator $20.00
Damsel and the Beast $15.00
House of Gnomes $16.00
ARCADE:
Mazogs $22.00
Invaders $10.00
Space Trek $12.00
UTILITIES:
ZXAS $12.00
ZXDB $15.00
ZXTK $14.00
And many, many more.
All prices include postage and packaging.
AK-BYTE
SOFTWARE
100 The Albany, Old Hall Street, Liverpool L3 9EP
England, U.K., The Earth.

8K ROM; 16K RAM

Managing with the ZX81

C. E. Coffin

The ZX81 with its full range of mathematical functions lends itself admirably to a variety of statistical tasks to aid businessmen in their work. An obvious field is operational (or operations) research. Few managers are likely themselves to be expert in the techniques of this powerful aid to effective management, or ever to want to apply linear programming or queuing theory (for example) to their problems. They will turn to specialists to advise them on such methods. But they may nevertheless appreciate that there are many situations in the daily management of their businesses where the use of simple statistical tests could enable them to identify a problem–or at least to know whether they had a problem or not.

Take the case of the production manager, for instance, whose plant is turning out its daily quota of widgets. He has been making strenuous efforts to improve productivity, and is watching the output figures anxiously day by day. When can he be sure that they truly reflect a significant improvement in the average achieved last month?

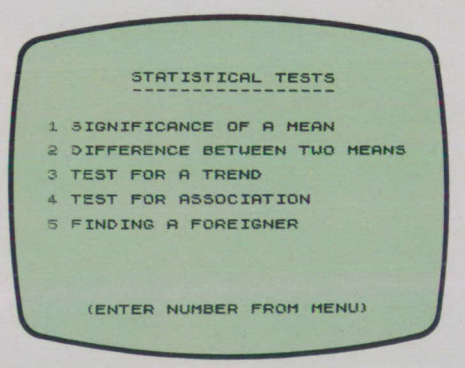
Or consider the sales director, reviewing the performance of the salesmen responsible for the two areas under his control. Their weekly totals of orders booked during the last three months fluctuate sharply, so that looking at the bare figures he cannot make up his mind whether it is Brown or Smith that has the better record recently. Is there a significant difference between the two sets of figures?

Or take, finally, the marketing man in charge of a product launch. He has staked his future with the company on the success of the new line, so he is desperate to show that his carefully planned campaign is paying off, and that the long haul into profitability for the product is under way. How can he demonstrate to the satisfaction of the board that this is so, and that there is a significant upward trend in sales and, hopefully, profits?

The program below, written for a ZX81 with 16K RAM, is designed to answer these and similar questions. It is, in fact, a suite of five programs linked together, with an initial menu to enable the user to choose from among them. It is based on a series of rapid statistical tests devised by Eric Duckworth, a noted writer on operational research.

Having chosen the test appropriate to his requirement, the user is prompted to enter the crude data at his disposal. The ZX81 tests this, makes the necessary calculations, and prints out an unequivocal message saying whether the result is statistically significant or not.

"Significant" has a meaning that is quite precise in this context, as applying to an event that would only rarely (once in twenty times, in fact) happen by chance. As Duckworth points out, this is a smaller probability than that of getting four "heads" with successive tosses of a coin, so that the tests in the program can be generally relied on to interpret fairly the data supplied. The sample runs shown with the listing indicate the way the program works, but for those who need more detail the following descriptions of the tests may be useful.


STATISTICAL TESTS
1 SIGNIFICANCE OF A MEAN
2 DIFFERENCE BETWEEN TWO MEANS
3 TEST FOR A TREND
4 TEST FOR ASSOCIATION
5 FINDING A FOREIGNER
(ENTER NUMBER FROM MENU)

Test 1: Significance of a Mean

The user enters the previous average when invited to do so, then the number of items in the new sample (which provides the subscript for an array to hold the data). Finally, the items in the sample are entered individually and displayed on the screen. The computer does not calculate a new average, though it could, of course, easily be programmed to do so. Instead, it notes how many figures are higher, and how many are lower, than the first average (ignoring any that are equal to it). It then calculates the sum of the two totals thus obtained and the difference between them: the rule for significance at the 1 in 20 level is that the difference must be greater than twice the square root of the sum.

If the ZX81 finds no significant change has occurred, it applies a further simple rule to tell the user how many more items of data are needed before a retest can usefully be carried out. (The relevant part of the program is lines 1230-1280, and if desired these could be adapted and added as a subroutine in tests 2-4.) This message is, however, omitted if more than 100 additional items would be needed—which would imply that the result of the initial test was far from significant.

Test 2: Significance of the Difference between Two Means

A test similar to the first can be used to determine whether two groups of figures differ significantly: for example, weekly orders taken by two salesmen. For the test to be meaningful, there must be at least five items in each group, and both groups must, of course, contain the same number of items. If there is a significant difference between the two, the computer will say whether the first sample is greater or less than the second.

Test 3: Test for a Trend

This test should tell our marketing man whether his new product is going to advance his career, or whether he should resign before he is asked to go. To apply the test, he will need to collect a series of at least 15 figures, which are then entered one by one when the computer asks for them. If they show a significant trend, the computer will show its direction, up or down.

Test 4: Test for Association

It is sometimes desired to find out whether there is a regular connection, or correlation, between two groups of numbers. Is the proportion of widgets found to be faulty, on inspection by quality control, rising as production goes up, for example? The *total* number of data items from samples (of equal size) of the two series of figures is entered, and then the items are input individually. The program (lines 4070-4250) counts the number of pairs of figures in which *both* members of the pair are higher or lower than the average of the series to which they are related. From the number thus arrived at, the number of pairs in which one figure is higher and one is lower than the respective average is subtracted. If the difference is greater than the square root of half the total number of

C. E. Coffin, 54 Cambridge Ave., New Malden, Surrey, England.

SINCLAIR/TIMEX USERS

NOW SYNERGISTIC OFFERS YOU THE 'SMART™' CHOICE DESIGN

THE ***SYSTEM LOGIC KBD-I***
'SMART™' KEYBOARD ENHANCEMENT FOR SINCLAIR/TIMEX COMPUTERS

All units shipped with silk screened graphics comparable to those of Sinclair/Timex machines. We regret these were not available for *this* advertisment.

SYSTEM LOGIC — KBD-1

The System Logic KBD-I Keyboard enhancement offers Sinclair ZX-80, ZX81 and Timex TS-100 users an intelligent keyboard peripheral.

A KBD-I allows an increase in user throughput by as much as 70% while reducing fatigue factor errors.

Now enter data and programs quickly without having to 'hunt' for key contacts. Each key produces 'tactile' feedback in addition to employing right-and left-hand 'smart' shift keys. The KBD-I remains in the shifted mode with a *single* keystroke, while exiting from the shifted mode with a second (left or right!) keystroke entry.

The KBD-I simplifies integrating your computer system into a professional or business application. The compact size of the KBD-I permits easy portability, its brushed aluminum black anodized cabinet is a cautious blend of attractive design and the highest quality engineering and manufacturing techniques.

SMART ™ features
Patent Pending

FEATURES

- 'SMART™' shift function
- Tactile feedback
- 59 keys (with left and right shifts)
- Standard (QWERTY) typewriter format
- Silk screen labels compatible with Sinclair/Timex keyboard
- Compact design
- Rugged yet attractive black anodized aluminum cabinet
- Simple installation
- Custom engineered for Sinclair/Timex computers
- Auto-repeat function (fast/slow modes)

SPECIFICATIONS

Contact resistance: 20Ω @ 1mA
Contact rating: 1.0V/A
Contact bounce: ⩽5.0mSec.
Switch life: 5.0×10^6 operations typical
Switch force: <9.0 oz.
Switch travel: .015 in.

MAIL ORDER TO:
SYNERGISTIC DESIGN
P.O. BOX 411023
CHICAGO, ILLINOIS 60641

*Illinois residents include 6% sales tax.

	PRICE	QTY.	AMT.
SYSTEM LOGIC KBD-I KEYBOARD	**$85.95 ***		
Shipping and handling (per unit)	**$ 4.95**		**$ 4.95**
Money order or check		TOTAL	

NAME_____

ADDRESS_____

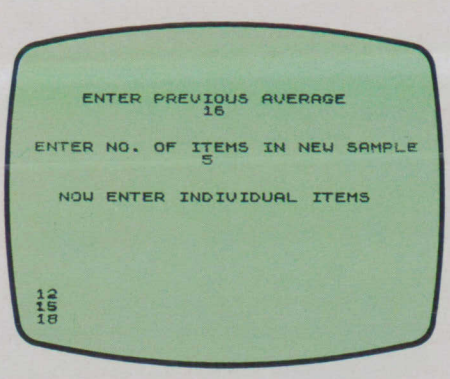
CITY_____ STATE_____ ZIP_____

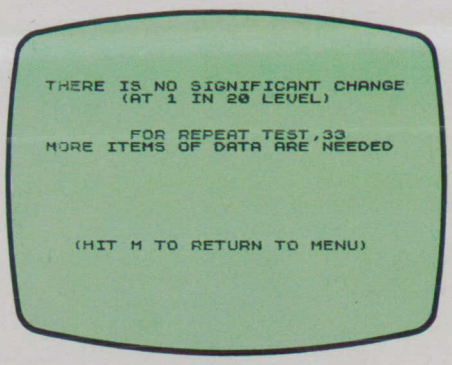
data items, the computer confirms that there is a significant association between the two series.

Test 5: Finding a Foreigner

Occasionally a series of numbers includes one that seems a "foreigner," out of line with the rest. Is it a random aberration, or should the manager suspect it, and decide that closer investigation is needed? The test applied here (lines 5000-5240) is to calculate the ration between the ranges of the largest and smallest numbers in the group—first without the "foreigner," and then with it included. If the ratio is less than 1:2, then the "foreigner" does not belong to the group, and some abnormality should be looked for in the conditions under which it was produced. The program assumes that the largest number in the group does not exceed 100,000; if larger numbers than this are likely to be met with, line 5050 should be altered.

Salesmen of computer systems are fond of claiming that their products are "menu-driven," and especially "user-friendly." Perhaps this early attempt at writing business software for the ZX81 that merits both these adjectives will inspire others to develop more sophisticated ways of using this versatile little machine as the basis of statistical systems for managers. ■






```
  10 REM STATISTICAL TESTS
  20 REM FOR MANAGERS
  30 REM (C) C E COFFIN, 1981
  35 CLS
  40 LET D=0
  50 LET S=0
  60 LET Z=0
  70 LET S$="SIGNIFICANT"
 100 PRINT TAB 7;"STATISTICAL TE
STS"
 110 PRINT TAB 7;"--------------
---"
 120 PRINT
 130 PRINT
 140 GOSUB 400
 170 PRINT AT 19,3;"(ENTER NUMBE
R FROM MENU)"
 200 INPUT X
 210 IF X<1 OR X>5 THEN GOTO 200
 220 CLS
 240 GOTO X*1000
 400 REM MENU DISPLAY
 410 DIM M$(5,30)
 420 LET M$(1)=" SIGNIFICANCE OF
 A MEAN"
 430 LET M$(2)=" DIFFERENCE BETW
EEN TWO MEANS"
 440 LET M$(3)=" TEST FOR A TREN
D"
 450 LET M$(4)=" TEST FOR ASSOCI
ATION"
 460 LET M$(5)=" FINDING A FOREI
GNER"
 500 FOR W=1 TO 5
 510 PRINT W;M$(W)
 520 PRINT
 530 NEXT W
 540 RETURN
 700 PRINT TAB 13;"---------"
 710 RETURN
1000 REM SIGNIFICANCE OF A MEAN
1005 PRINT TAB 4;M$(1)
1006 GOSUB 700
1010 PRINT AT 6,4;"ENTER PREVIOU
S AVERAGE"
1020 INPUT A
1030 PRINT TAB 14;A
1040 PRINT AT 10,0;"ENTER NO. OF
 ITEMS IN NEW SAMPLE"
1050 PRINT AT 11,14;
1060 GOSUB 6000
1070 PRINT AT 14,2;"NOW ENTER IN
DIVIDUAL ITEMS"
1080 FOR L=1 TO T
1090 SCROLL
1100 INPUT N(L)
1110 PRINT N(L)
1120 IF N(L)<A THEN LET J=J+1
1130 IF N(L)>A THEN LET K=K+1
1140 NEXT L
1150 GOSUB 1500
1170 CLS
1180 PRINT AT 6,0;"THERE IS ";
1190 IF D<=Z THEN PRINT "NO ";
1200 PRINT S$;" CHANGE"
1210 PRINT TAB 6;"(AT 1 IN 20 LE
VEL)"
1220 IF D=0 OR D>Z THEN GOTO 650
0
1230 LET E=INT (((2*S)/D)**2)-5
1240 IF E>0 AND E<100 THEN GOTO
1260
1250 GOTO 6500
1260 PRINT AT 10,7;"FOR REPEAT T
EST,";E
1270 PRINT "MORE ITEMS OF DATA A
RE NEEDED"
1280 GOTO 6500
1500 LET S=J+K
1510 LET Z=2*SQR S
1520 LET D=ABS (J-K)
1530 RETURN
2000 REM DIFFERENCE BETWEEN TWO
MEANS
2005 PRINT TAB 1;M$(2)
2010 GOSUB 700
2015 PRINT AT 6,2;"NO. OF ITEMS
IN EACH SAMPLE"
2020 PRINT TAB 9;"(AT LEAST 5)?
";
2030 GOSUB 6000
2050 PRINT AT 10,1;"NOW ENTER ON
E ITEM FROM EACH "
2060 PRINT TAB 7;"SAMPLE AT A TI
ME"
2090 DIM R(T)
2120 FOR L=1 TO T
2130 SCROLL
2140 INPUT N(L)
2150 INPUT R(L)
2160 PRINT N(L),R(L)
2170 IF N(L)>R(L) THEN LET J=J+1
2180 IF N(L)<R(L) THEN LET K=K+1
2190 NEXT L
2210 GOSUB 1500
2230 CLS
2240 PRINT AT 8,9;"1ST SAMPLE IS
 "
2250 IF D>Z THEN GOTO 2300
2260 PRINT "NOT ";S$;"LY DIFFERE
NT FROM"
2270 GOTO 2350
2300 IF J>K THEN PRINT TAB 2;S$;
"LY GREATER THAN"
2310 IF J<K THEN PRINT TAB 3;S$;
"LY LESS THAN"
2350 PRINT TAB 10;"2ND SAMPLE"
2360 GOTO 6500
3000 REM TEST FOR A TREND
3005 PRINT TAB 8;M$(3)
3010 GOSUB 700
3015 PRINT AT 8,5;"NO. OF ITEMS
IN SAMPLE"
3020 PRINT TAB 7;"(AT LEAST 15)?
";
3030 GOSUB 6000
3040 LET T1=INT (T/3)
3050 PRINT AT 12,5;"ENTER ITEMS
ONE BY ONE"
3060 FOR L=1 TO T
3070 SCROLL
3080 INPUT N(L)
3090 PRINT N(L)
3100 NEXT L
3110 CLS
3120 LET Q=T-T1
3130 FOR P=1 TO T1
3150 IF N(P)<N(Q) THEN LET J=J+1
3190 IF N(P)>N(Q) THEN LET K=K+1
3200 LET Q=Q+1
3210 NEXT P
3220 CLS
3230 LET Y=2*(SQR T1)
3240 PRINT AT 8,3;"TREND IS ";
3250 IF ABS (J-K)<=Y THEN GOTO 3
350
3260 PRINT S$;"LY"
3270 IF J>K THEN PRINT TAB 12;"U
P";
3280 IF J<K THEN PRINT TAB 10;"D
OWN";
3290 PRINT "WARDS"
3300 GOTO 6500
3350 PRINT "NOT ";S$
3360 GOTO 6500
4000 REM TEST FOR ASSOCIATION
4001 PRINT TAB 6;M$(4)
4002 GOSUB 700
4005 PRINT AT 7,2;"SAMPLES MUST
BE OF EQUAL SIZE"
4010 PRINT TAB 4;"TOTAL NO. OF I
TEMS ";
4020 GOSUB 6000
4030 LET TOT1=0
4040 LET TOT2=0
4050 PRINT AT 11,0;"ENTER ONE IT
EM FROM EACH SAMPLE"
4060 PRINT TAB 11;"AT A TIME"
4070 LET P=1
4080 FOR Q=2 TO T STEP 2
4090 SCROLL
4100 INPUT N(P)
4110 INPUT N(Q)
4120 PRINT N(P),N(Q)
4130 LET TOT1=TOT1+N(P)
4140 LET TOT2=TOT2+N(Q)
4150 LET P=P+2
4160 NEXT Q
4170 CLS
4180 LET AV1=TOT1/(T/2)
4190 LET AV2=TOT2/(T/2)
4200 LET P=1
4210 FOR Q=2 TO T STEP 2
4220 IF ((N(P)<AV1) AND (N(Q)<AV
2)) OR ((N(P)>AV1) AND (N(Q)>AV2
)) THEN LET J=J+1
4225 LET K=(T/2)-J
4230 IF (N(P)=AV1) OR (N(Q)<AV2)
 THEN LET K=K-1
4240 LET P=P+2
4250 NEXT Q
4260 LET Z=2*(SQR (T/2))
4270 PRINT AT 8,10;"THERE IS ";
4280 IF ABS (J-K)<=Z THEN GOTO 4
310
4290 PRINT "A"
4300 GOTO 4320
4310 PRINT "NO"
4320 PRINT TAB 4;S$;" ASSOCIATIO
N"
4330 PRINT TAB 4;"BETWEEN THE TW
O SAMPLES"
4340 GOTO 6500
5000 REM FINDING A FOREIGNER
5005 PRINT TAB 6;M$(5)
5006 GOSUB 700
5010 PRINT AT 7,5;"NO. OF ITEMS
IN SAMPLE"
5015 PRINT TAB 5;"(WITHOUT FOREI
GNER)? ";
5020 GOSUB 6000
5030 PRINT
5040 PRINT AT 11,1;"ENTER ITEMS
(WITHOUG FOREIGNER)"
5050 LET K=100000
5060 FOR L=1 TO T
5070 SCROLL
5080 INPUT N(L)
5090 PRINT N(L)
5100 IF J<N(L) THEN LET J=N(L)
5110 IF K>N(L) THEN LET K=N(L)
5120 NEXT L
5130 CLS
5140 PRINT AT 8,4;"ENTER THE FOR
EIGNER:";
5150 INPUT F
5160 PRINT F
5170 LET Y1=ABS (J-K)
5180 IF J<F THEN LET J=F
5190 IF K>F THEN LET K=F
5195 LET Y2=ABS (J-K)
5200 PRINT AT 12,5;F;" IS";
5210 IF Y2/Y1>2 THEN GOTO 5230
5220 PRINT " NOT";
5230 PRINT " A FOREIGNER"
5240 GOTO 6500
6000 INPUT T
6010 PRINT T
6020 DIM N(T)
6030 LET J=0
6040 LET K=0
6050 RETURN
6500 PRINT AT 19,2;"(HIT M TO RE
TURN TO MENU)"
6510 PAUSE 4E4
6520 IF CODE INKEY$=50 THEN GOTO
 35
6530 STOP
```

SOFTSYNC—ONE STEP AHEAD
FOR TS1000/ZX81 SOFTWARE

PRICES RANGE FROM $14.95 TO $19.95

SOFTSYNC, INC.

For more information send for free catalog and free program listing to:
SOFTSYNC, INC.
14 E. 34TH ST., NEW YORK, N.Y. 10016
(212) 685-2080
MC/Visa Accepted

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

8K ROM; 16K RAM

Archaeological Research Using the ZX81

Juan Jose Castillos

I am an Egyptologist, and for the last six years I have been busy doing a survey of ancient Egyptian Predynastic and Early Dynastic cemeteries to establish some of the demographic, economic, and sociological conditions under which the population of the time had to live.

The computer has been used for many years as a tool for carrying out archaeological projects and, more specifically, in Egyptological research. However, scholars who want to use these modern machines often have to compete for time at the big university computers with other specialists. Furthermore, due to the complexities involved, they have to rely on professional programmers who, it is hoped, will understand the particular nature and purpose of each project and thus use the machine to the scholar's best possible advantage.

To what extent this has been achieved is up to each individual to decide, but recently, the advent of a whole generation of powerful, affordable microcomputers has freed scholars from their dependence on outside help. Now it is possible not only for Departments or Research Centers but even for one single person to acquire a computer. The researcher can devise his own programs, and proceed with his work at a much faster pace.

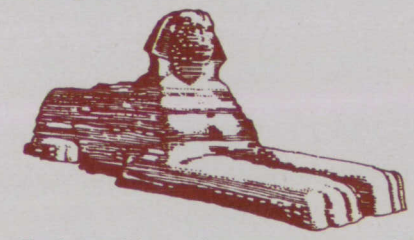
Until a couple of years ago, we had to rely on file-cards and indexes to store data. There is no need to elaborate on how tedious, slow, and error-prone this system really is, but at the time there was no feasible alternative.

When the first micrcomputers became available, I decided to buy one—a Sinclair ZX80 and then a ZX81. The enormous potential of these very moderately priced machines for archaeological projects was quickly evident. Not only are they reasonably accurate and extremely reliable, but also their versatility raised the possibility of use for other forms of scientific research such as the handling of complex mathematical formulae for statistical and other purposes. The graphics offer a great variety of displays, and the Sinclair Basic with its one keystroke entries is very user-friendly.

Juan Jose Castillos, PO Box 7274, Station A, Toronto, Ontario, Canada M5W 1X9.

After developing a suitable program, I found that I could work at ten times the speed I had been used to. As a result, a project that was calculated to take at least ten years to complete could be finished and properly published early in 1982. (If you are interested in the results of this study and the kind of analysis made possible by the ZX81, you can find it in my article in *The Journal of the Society for the Study of Egyptian Antiquities* January 1982, and in my book *A Reappraisal of the Published Evidence on Predynastic and Early Dynastic Cemeteries* Toronto, 1982.)

The program below can be used on a ZX80 (8K ROM) since it was designed in FAST mode for greater speed and we took care to include the required POKEs after every PAUSE. Since ZX81 owners have a choice of FAST or SLOW, they will have to change if necessary, line 2 of the program.



Both machines allow a maximum of 90 entries (or tombs in this case) with the 16K RAM pack. Those who own a 64K RAM pack (which actually provides 48K RAM for normal Basic use), by the simple procedure of raising RAMTOP to the 64K location area will be able to enter as many as 1,000 tombs. In our case the addon was Memotech's MEMPAK 64K which has an initial powerup RAMTOP of 16K which can be increased to the maximum possible value by POKEing 16389,255, and NEWLINE, then NEW and NEWLINE. For other memory expansion packs the procedure may vary so the user should consult his manual.

With slight modifications, this program can be adapted to other categories of archaeological data such as pottery, artefacts, or settlement research.

The possibilities of the ZX81 are not exhausted by this program. Among other things, the high resolution capabilities of the ZX Printer enabled us to write a program which generated user-designed characters, in our case, Egyptian hieroglyphics. This feature could be easily used to print Chinese characters, Russian or Greek letters, or a lower-case set of letters. Our program works like a typewriter sending into memory one character every time a key is pressed, by the time 32 have been entered, the printer prints a line and is ready for the next one. In this case one of the much-criticized features of the ZX81, namely, the flat keyboard, proved to be very convenient since it allows the user to place opaque overlays in which the Sinclair keyboard characters have been replaced by others. Thus we could use the keyboard directly without constant consultation of lists or tables.

I hope that our results will be a source of inspiration to fellow archaeologists and other researchers who are still toiling away with pen and paper or competing for time at the big university computers and that they will be persuaded to switch to more efficient and remarkably economical ways of handling their data such as those offered by the ZX81.

Program Notes

The SYNCSUM for this program as listed is 103. Note that this program should only be RUN once and that is when you will start to enter your data. After that, go back to the menu by entering GOTO 120. Otherwise you will lose your variables which are cleared by RUN.

The program is mostly self-explanatory, but a few comments on some of the lines may help other users to adapt it to their work.

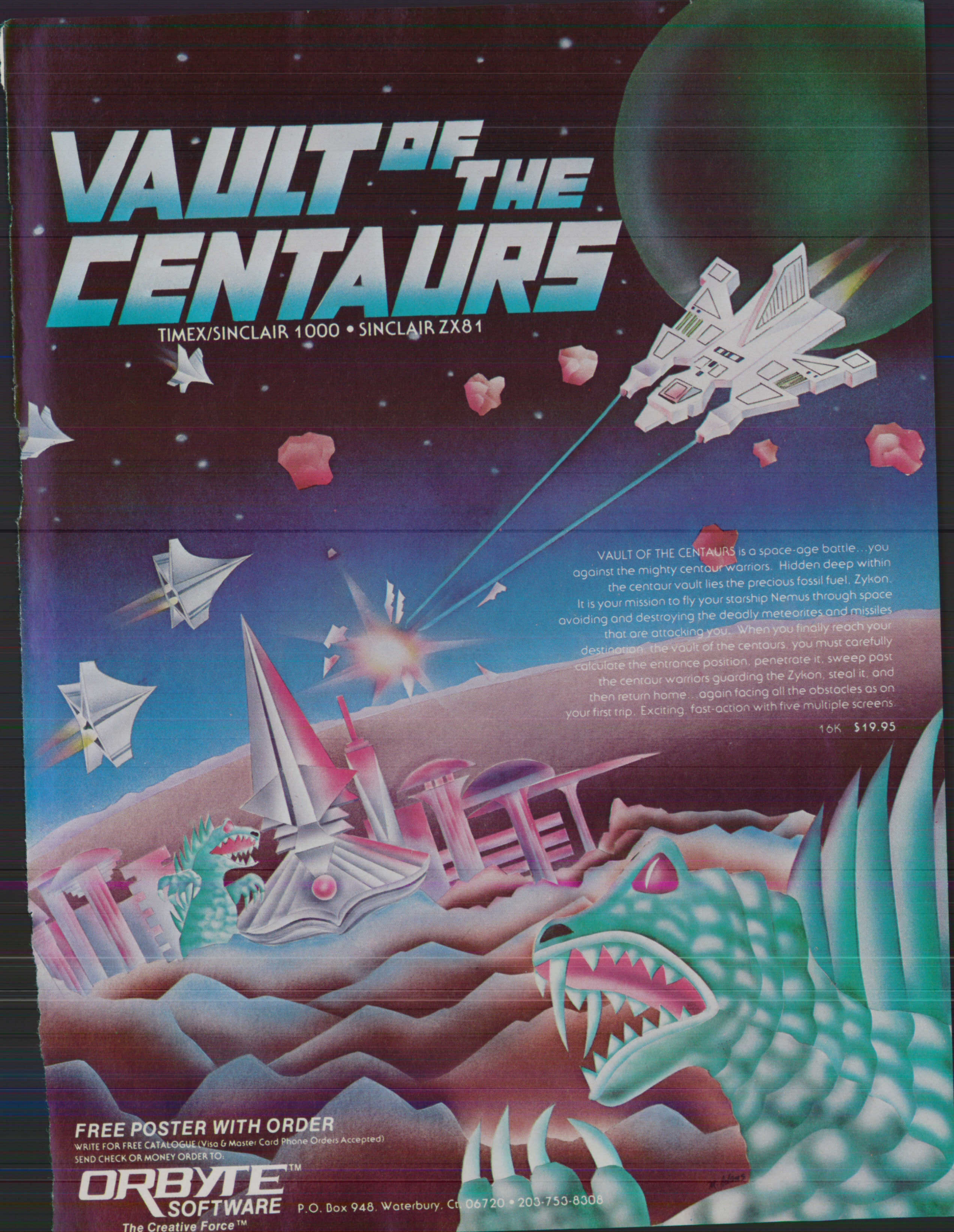
1-40: These lines define variables and reserve space for them. If you plan to make 1,000 entries, change line 32 to read R$ (1000,32) and attach a 64K pack or a combination of other RAM packs to a total of 48K.

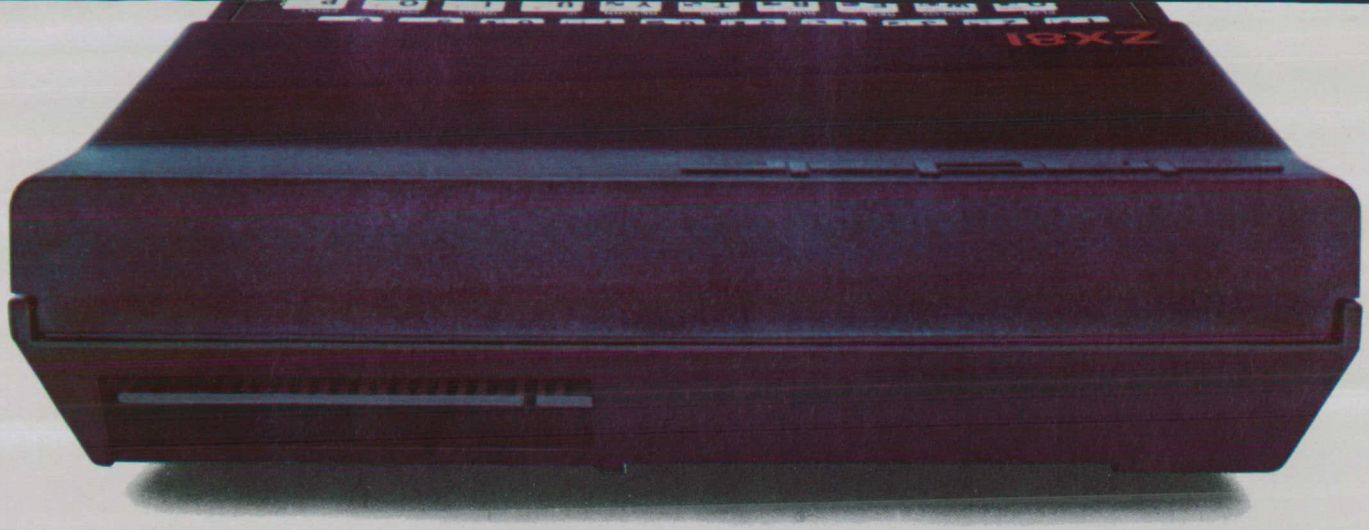
It is advisable to dimension R$ to the value you need and no more because the ZX81 gets increasingly slow as you raise RAMTOP. For this reason keep RAMTOP as low as possible.

Furthermore, you should be very careful when you dimension your arrays in lines 1 to 40, especially line 32, since once you define them and RUN the program to begin, you are stuck with them and only another RUN will enable you to modify them. This would result in the loss of all variables. While you enter your data, it would be wise to use number 8 in the menu from time to time so as to be aware of how much memory you still have available.

120-180: This is the menu. Lines 122-127 can be altered to describe the subject of the research and the units of measurement. (cm., inches, etc.).

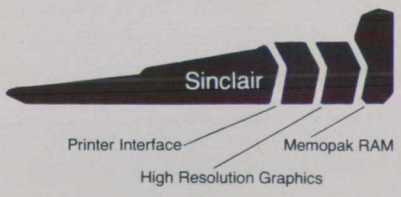
2500-2860: This subroutine displays a record which has one given characteristic (certain size group of tombs or certain


VAULT OF THE CENTAURS
TIMEX/SINCLAIR 1000 • SINCLAIR ZX81
VAULT OF THE CENTAURS is a space-age battle...you against the mighty centaur warriors. Hidden deep within the centaur vault lies the precious fossil fuel, Zykon. It is your mission to fly your starship Nemus through space avoiding and destroying the deadly meteorites and missiles that are attacking you. When you finally reach your destination, the vault of the centaurs, you must carefully calculate the entrance position, penetrate it, sweep past the centaur warriors guarding the Zykon, steal it, and then return home...again facing all the obstacles as on your first trip. Exciting, fast-action with five multiple screens.
16K $19.95
FREE POSTER WITH ORDER
WRITE FOR FREE CATALOGUE (Visa & Master Card Phone Orders Accepted)
SEND CHECK OR MONEY ORDER TO:
ORBYTE™ SOFTWARE
The Creative Force™
P.O. Box 948, Waterbury, Ct. 06720 • 203-753-8308



BEHIND EVERY GOOD SINCLAIR IS A MEMOPAK

If you own a Timex-Sinclair 1000 or ZX81 computer, you should have a Memopak behind it. From increased memory to high resolution graphics, Memotech has a Memopak to boost your system's capabilities. Every Memopak peripheral comes in a black anodised aluminum case and is designed to fit together in "piggy back" fashion to enable you to continue to add on and still keep an integrated system look.



Order at no risk

All Memotech products carry our 10 day money back guarantee. If you're not completely satisfied, return it in ten days and we will give you a full refund. And every Memotech product comes with a six month warranty. Should anything be defective with your Memopak, return it to us and we will repair or replace it free of charge. Dealer inquiries welcome. To order any Memotech product call our toll-free number **800/662-0949** or use the order coupon.

MEMOTECH
CORPORATION

7550 West Yale Avenue
Denver, Colorado 80227
(303) 986-1516
TWX 910-320-2917

Mail to: Memotech Corporation, 7550 West Yale Ave., Denver, CO 80227

Code: SYCO-3-4

	*Price	Qty	Total
64K RAM	$179.95		
32K RAM	109.95		
16K RAM	59.95		
Centronics Parallel Printer Interface	104.95		
RS232 Printer Interface	139.95		
High Resolution Graphics	144.95		
Shipping and handling	4.95		$4.95

* All prices quoted in U.S. dollars
** Colorado residents please add sales tax
☐ Check ☐ MasterCard ☐ Visa

Tax**
Total

Account No. _____ Exp. _____

Name

Address

City State Zip

Memopak 64K RAM The 64K RAM extends the memory of your Sinclair by 56K to a full 64K. It is directly addressable, user transparent, is neither switched nor paged and accepts such BASIC commands as 10 DIM A (9000). The Memopak 64K turns your Sinclair into a powerful computer suitable for business, recreational and educational use. No additional power supply is required.

Memopak 32K RAM The 32K RAM Memopak offers your Sinclair a full 32K of directly addressable RAM. Like the 64K Memopak, it is neither switched nor paged and enables you to execute sophisticated programs and store large data bases. It is also fully compatible with Sinclair's or Memotech's 16K RAM to give you a full 48K of RAM.

Memopak 16K RAM The Memopak 16K RAM provides an economical way to increase the capabilities of your Sinclair. And at the same time, it enables you to continue to add on other features with its "piggy back" connectors. It is compatible with the Sinclair 16K or a second Memopak 16K or Memopak 32K to give 32K or 48K of RAM respectively.

Memopak High Resolution Graphics The Memopak HRG contains a 2K EPROM monitor and is fully programmable for high resolution graphics. The HRG provides for up to 192 by 248 pixel resolution.

Memopak Printer Interface The Memopak Centronics Parallel or RS232 Interface paks enable your Sinclair to use a wide range of compatible printers (major manufacturers' printers available through Memotech at significant savings). The resident software in the units gives the ASCII set of characters. Both Memopak printer interfaces provide lower case character capabilities. The RS232 Interface is also compatible with modems.

New products coming soon Memotech will soon be introducing four new Sinclair compatible products: a high quality, direct connection keyboard, a digitizing tablet, a 16K EPROM and a disk drive. Watch for our future advertisements.

MEMOTECH INTRODUCES THE ZX81/TS-1000 KEYBOARD

The Memotech keyboard is a high quality standard (typewriter) keyboard, with Sinclair legends. The keyboard is housed in a well engineered and elegant aluminium enclosure. It is cable connected to the accompanying buffered interface which is housed in a Memopak case and plugs directly onto the back of the computer. As with other Memotech products, the piggy-back tradition is maintained, allowing other add-ons to be plugged onto the back of the interface. **Priced at $99.95** (Plus $4.95 for shipping and handling).

THE FOLLOWING PRINTERS ARE ALSO AVAILABLE THROUGH MEMOTECH

SEIKOSHA GP 100

The Seikosha GP 100 uses a 5x7 dot matrix printing format with ASCII standard upper and lower case character set. Printing speed is 30 characters/second with a maximum width of 80 characters. Character spacing is 10 characters/inch with line spacing of 6 lines/inch or 9 lines/inch. The printer uses standard fanfold paper up to $9\frac{1}{2}$ inches wide. The GP 100 utilizes a standard parallel interface (Centronics compatible).
Priced at $399.00 including Centronics parallel interface & cable. (Plus $9.95 for shipping and handling).

SEIKOSHA GP 250

The GP 250 is also manufactured by Seikosha, the leading company of the Seiko group. It uses a 5x8 dot matrix printing format with ASCII standard upper and lower case character set. Printing speed is 50 characters/second with a maximum width of 80 characters. Character spacing is 10 characters/inch. The GP 250 also uses paper up to $9\frac{1}{2}$ inches wide. This printer utilizes either standard parallel Centronics interface or serial (RS232, DIN connector) interface.
Priced at $449.00 including Centronics parallel interface & cable. (Plus $9.95 for shipping and handling).

PROWRITER 8510

The Prowriter 8510 is a Leading Edge product. It uses a 7x9 dot matrix printing format with ASCII standard upper and lower case character set. The printing speed on the 8510 is 120 characters/second with a maximum width of 80 characters. The 8510 utilizes a standard Centronics parallel interface.
Priced at $649.00 including Centronics parallel interface & cable. (Plus $9.95 for shipping and handling).

To order any of the above items, call Toll Free 1 800 662 0949 or write:

MEMOTECH CORPORATION
7550 W. Yale Avenue, #200
Denver, CO 80227

shape, etc.) and at the same time, adds up the number of the records thus displayed so as to provide a total at the end of the search.

3500-3786: This routine is similar to the above but reserved for binary or multiple comparisons (i.e., tombs sharing more than one characteristic such as certain size group *and* the shape of the tomb *and* the sex of the occupant, etc.). The program STOPs at line 3515 to allow you to modify line 3754 to suit your needs. After this is done, press CONTINUE.

5000-5590: Since this subroutine is connected to number 1 in the menu which generates the file, special care was taken to make sure that the computer will only accept valid entries. The code for the entries is given in Figure 1, but can be modified at will simply by changing the content of these lines. Number 4 in the menu alters the records and also uses this "safe" subroutine.

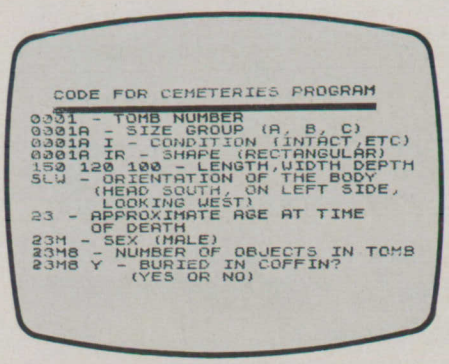
9300-9390: This subroutine analyzes the record numbers entered to make sure that they are valid.

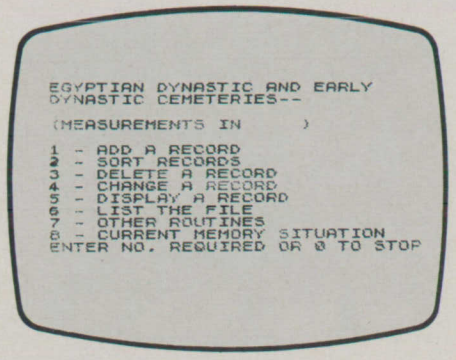
You can SAVE the program at any stage by entering the command GOTO 9500. Make sure that you have started your tape recorder and also that your earphone wire is disconnected before you enter this command.

One drawback users will quickly identify is the length of time that SAVEing or LOADing 16K or more takes at the ZX81's leisurely pace of 250 BAUD. However, the use of a QSAVE machine, which by-passes the computer's ROM SAVE and LOAD routines and carries out the task at a speedy rate of 4000 BAUD, cut down the waiting time from over six minutes to only 25 seconds. If you use a good quality tape recorder and spend some time finding the right volume setting, the QSAVE machine and accompanying software can be very reliable and perhaps even eliminate the need for more expensive stringy-floppy systems or disk drives.

```
  1 REM [redacted]
  2 FAST
  3 DIM A$(4,4)
  4 DIM B$(4,1)
  6 DIM C$(1)
  8 DIM D$(3,1)
 10 DIM E$(4,1)
 12 DIM F$(2,5)
 14 DIM G$(2,5)
 16 DIM H$(2,3)
 18 DIM I$(5,1)
 20 DIM J$(3,1)
 22 DIM K$(5,1)
 24 DIM L$(6,2)
 26 DIM M$(4,1)
 28 DIM N$(2,2)
 30 DIM O$(2,1)
 32 DIM R$(90,32)
 34 DIM Z$(1)
 35 DIM X$(4)
 36 DIM U$(32)
 38 LET N=0
 40 LET C$=" "
120 CLS
121 PRINT
122 PRINT "EGYPTIAN PREDYNASTIC
AND EARLY"
123 PRINT "DYNASTIC CEMETERIES-
"
124 PRINT
127 PRINT "(MEASUREMENTS IN
)"
128 PRINT
129 PRINT
130 PRINT
132 PRINT "1 - ADD A RECORD"
135 PRINT "2 - SORT RECORDS"
140 PRINT "3 - DELETE A RECORD"
145 PRINT "4 - CHANGE A RECORD"
150 PRINT "5 - DISPLAY A RECORD
"
155 PRINT "6 - LIST THE FILE"
156 PRINT "7 - OTHER ROUTINES"
157 PRINT "8 - CURRENT MEMORY S
ITUATION"
158 PRINT AT 19,0;"ENTER NO. RE
QUIRED OR 0 TO STOP"
160 INPUT Z$
165 IF Z$="0" THEN STOP
170 LET MO=CODE Z$-28
175 IF MO<1 OR MO>8 THEN GOTO 1
60
180 GOTO 500*MO
500 LET RN=N+1
510 GOSUB 5000
520 IF RN=N+2 THEN LET N=N+1
530 PRINT AT 20,0;"PRESS NEWLIN
E TO ADD RECORD ";RN
540 PRINT AT 21,6;"OR M FOR MEN
U"
550 INPUT Z$
560 IF Z$=" " THEN GOTO 510
570 IF Z$="M" THEN GOTO 120
580 GOTO 550
1000 CLS
1002 PRINT AT 20,0;"SORTING..."
1003 PRINT AT 2,0;"THIS PROGRAM
SORTS BY TOMB"
1004 PRINT AT 4,0;"NUMBER. SORT
BY OTHER VARIABLES"
1005 PRINT AT 6,0;"MODIFYING AT
WILL LINE 1020."
1007 PAUSE 500
1008 POKE 16437,255
1009 FOR P=N-1 TO 1 STEP -1
1010 FOR Q=1 TO P
1020 IF R$(Q,1 TO 4)<=R$(Q+1,1 T
O 4) THEN GOTO 1060
1030 LET U$=R$(Q)
1035 LET R$(Q)=R$(Q+1)
1040 LET R$(Q+1)=U$
1060 NEXT Q
1070 NEXT P
1080 PRINT AT 20,0;"SORT COMPLET
ED"
1090 PAUSE 400
1100 POKE 16437,255
1110 GOTO 120
1500 CLS
1505 PRINT AT 20,0;"ENTER NO. OF
 RECORD FOR DELETION"
1510 INPUT X$
1520 GOSUB 9300
1522 IF NOT OK THEN GOTO 1510
1524 LET D=VN
1530 PRINT AT 21,0;"DELETING..."
1540 FOR I=D TO N-1
1550 LET R$(I)=R$(I+1)
1560 NEXT I
1570 LET N=N-1
1580 CLS
1590 PRINT AT 19,0;"RECORD ";D;"
 HAS BEEN DELETED"
1600 PRINT AT 20,0;"PRESS NEWLIN
E FOR MORE DELETIONS"
1610 PRINT AT 21,6;"OR M FOR MEN
U"
1620 INPUT Z$
1630 IF Z$=" " THEN GOTO 1500
1640 IF Z$="M" THEN GOTO 120
1650 GOTO 1620
2000 CLS
2010 PRINT AT 20,0;"ENTER NUMBER
 OF RECORD"
2020 INPUT X$
2030 GOSUB 9300
2040 IF NOT OK THEN GOTO 2020
2050 LET RN=VN
2100 GOSUB 5000
2200 PRINT AT 20,0;"PRESS NEWLIN
E TO CHANGE ANOTHER"
2210 PRINT AT 21,6;"OR M FOR MEN
U"
2220 INPUT Z$
2230 IF Z$=" " THEN GOTO 2000
2240 IF Z$="M" THEN GOTO 120
2250 GOTO 2220
2500 CLS
2510 PRINT AT 2,0;"SPECIFY ONE O
F THE FOLLOWING:"
2520 PRINT AT 4,0;"[redacted]
"
2522 PRINT "[redacted]"
2524 PRINT "[redacted]"
2526 PRINT "[redacted]"
2528 PRINT "[redacted]"
2530 PRINT "[redacted]"
2532 PRINT "[redacted]"
2534 PRINT "[redacted]
"
2536 PRINT "[redacted]"
2538 PRINT "[redacted]"
2540 PRINT "[redacted]
[redacted]"
2542 PRINT "[redacted]
[redacted]"
2544 PRINT "[redacted]
[redacted]"
2546 PRINT "[redacted]
[redacted]"
2548 PRINT AT 20,0;"ENTER VALUE
OR NEWLINE FOR EACH"
2550 INPUT A$(4)
2552 PRINT AT 4,14;A$(4)
2554 INPUT B$(1)
2556 PRINT AT 5,14;B$(1)
2558 INPUT D$(1)
2560 PRINT AT 6,12;D$(1)
2562 INPUT E$(1)
2564 PRINT AT 7,12;E$(1)
2566 INPUT F$(1)
2568 PRINT AT 8,8;F$(1)
2570 INPUT G$(1)
2572 PRINT AT 9,8;G$(1)
2574 INPUT H$(1)
2576 PRINT AT 10,8;H$(1)
2578 INPUT I$(1)
2580 PRINT AT 11,22;I$(1)
2582 INPUT J$(1)
2584 PRINT AT 12,22;J$(1)
2586 INPUT K$(1)
2588 PRINT AT 13,22;K$(1)
2590 INPUT L$(1)
2592 PRINT AT 14,30;L$(1)
2594 INPUT M$(1)
2596 PRINT AT 15,25;M$(1)
2598 INPUT N$(1)
2600 PRINT AT 16,26;N$(1)
2602 INPUT O$(1)
2604 PRINT AT 17,27;O$(1)
2650 PRINT AT 20,0;"SEARCHING...
"
2652 PAUSE 200
2654 POKE 16437,255
2655 LET T=0
2660 FOR Q=1 TO N
2670 IF R$(Q,1 TO 4)=A$(4) OR R$
(Q,5)=B$(1) OR R$(Q,7)=D$(1) OR
R$(Q,8)=E$(1) OR R$(Q,10 TO 12)=
F$(1) OR R$(Q,14 TO 16)=G$(1) OR
 R$(Q,18 TO 20)=H$(1) OR R$(Q,22
)=I$(1) OR R$(Q,23)=J$(1) OR R$(
Q,24)=K$(1) OR R$(Q,26 TO 27)=L$
(1) OR R$(Q,28)=M$(1) OR R$(Q,29
 TO 30)=N$(1) OR R$(Q,32)=O$(1)
THEN GOTO 2715
2680 NEXT Q
2690 CLS
2700 PRINT AT 10,5;"NO RECORD FO
UND"
2705 PRINT AT 4,1;"LAST DISPLAY
WAS NO. ";T
2710 GOTO 2810
2715 LET T=T+1
2716 CLS
2718 PRINT
2720 PRINT TAB 10;"RECORD NO. ";
Q
2722 PRINT AT 4,0;"DISPLAY NO. "
;T
2730 PRINT AT 12,0;R$(Q,1 TO 4);
R$(Q,5);C$;R$(Q,7);R$(Q,8);C$;R$
(Q,10 TO 12);C$;R$(Q,14 TO 16);C
$;R$(Q,18 TO 20);C$;R$(Q,22);R$(
Q,23);R$(Q,24);C$;R$(Q,26 TO 27)
;R$(Q,28);R$(Q,29 TO 30);C$;R$(Q
,32)
2810 PRINT AT 20,0;"PRESS NEWLIN
E FOR ANOTHER RECORD"
2820 PRINT AT 21,6;"OR M FOR MEN
U"
2830 INPUT Z$
2840 IF Z$=" " THEN GOTO 2680
2850 IF Z$="M" THEN GOTO 120
2860 GOTO 2830
3000 CLS
3010 PRINT TAB 10;"LIST RECORDS"
3011 PRINT AT 3,0;"TOTAL: ";N;"
RECORDS IN MEMORY"
3020 PRINT AT 20,0;"DO YOU WANT
A FULL LIST, Y OR N?"
3030 INPUT Z$
3040 IF Z$="Y" THEN GOTO 3065
3050 IF Z$="N" THEN GOTO 120
3060 GOTO 3030
3065 CLS
3070 FOR Z=1 TO N
3080 SCROLL
3090 PRINT AT 21,0;R$(Z,1 TO 4);
R$(Z,5);C$;R$(Z,7);R$(Z,8);C$;R$
(Z,10 TO 12);C$;R$(Z,14 TO 16);C
$;R$(Z,18 TO 20);C$;R$(Z,22);R$(
Z,23);R$(Z,24);C$;R$(Z,26 TO 27)
;R$(Z,28);R$(Z,29 TO 30);C$;R$(Z
,32)
3105 PAUSE 100
3110 POKE 16437,255
3111 NEXT Z
3115 PAUSE 1000
3116 POKE 16437,255
3120 GOTO 120
3500 CLS
3510 PRINT AT 1,0;"FOR BINARY
MULTIPLE COMPARISON"
3511 PRINT AT 2,0;"ADJUST LINE 3
754 IN PROGRAM"
3515 STOP
3520 PRINT AT 3,0;"SPECIFY SOME
OF THE FOLLOWING:"
3530 PRINT AT 4,0;"[redacted]
"
3540 PRINT "[redacted]"
3550 PRINT "[redacted]"
3560 PRINT "[redacted]"
3570 PRINT "[redacted]"
3580 PRINT "[redacted]"
3590 PRINT "[redacted]"
3500 PRINT "[redacted]
"
3510 PRINT "[redacted]"
3520 PRINT "[redacted]"
3530 PRINT "[redacted]
[redacted]"
3540 PRINT "[redacted]
[redacted]"
3550 PRINT "[redacted]
[redacted]"
3560 PRINT "[redacted]
[redacted]"
3570 PRINT AT 20,0;"ENTER VALUE
OR NEWLINE FOR EACH"
3580 INPUT A$(4)
3590 PRINT AT 4,14;A$(4)
3592 INPUT B$(1)
3594 PRINT AT 5,14;B$(1)
3596 INPUT D$(1)
```

Figure 1.


CODE FOR CEMETERIES PROGRAM
0001 - TOMB NUMBER
0001A - SIZE GROUP (A, B, C)
0001A I - CONDITION (INTACT,ETC)
0001A IR - SHAPE (RECTANGULAR)
150 120 100 - LENGTH,WIDTH,DEPTH
SLW - ORIENTATION OF THE BODY
(HEAD SOUTH, ON LEFT SIDE,
LOOKING WEST)
23 - APPROXIMATE AGE AT TIME
OF DEATH
23M - SEX (MALE)
23M8 - NUMBER OF OBJECTS IN TOMB
23M8 Y - BURIED IN COFFIN?
(YES OR NO)


EGYPTIAN DYNASTIC AND EARLY
DYNASTIC CEMETERIES--
(MEASUREMENTS IN)
1 - ADD A RECORD
2 - SORT RECORDS
3 - DELETE A RECORD
4 - CHANGE A RECORD
5 - DISPLAY A RECORD
6 - LIST THE FILE
7 - OTHER ROUTINES
8 - CURRENT MEMORY SITUATION
ENTER NO. REQUIRED OR 0 TO STOP

Variables Used

Arrays A$ to O$: These arrays determine the content of the file. Change the PRINT statements related to them and their dimensions in order to adapt this program to your own research parameters.

Array R$: Contains all other arrays and forms a unit (tomb, dwelling, workshop, etc.).

Arrays Z$ to W$: General utility arrays used throughout the program as the need arises.

N, RN, VN, D, etc.: These numeric variables control the number of units (e.g., tombs) on file. ■

```
3698 PRINT AT 6,12;D$(1)
3700 INPUT E$(1)
3702 PRINT AT 7,12;E$(1)
3704 INPUT F$(1)
3706 PRINT AT 8,8;F$(1)
3708 INPUT G$(1)
3710 PRINT AT 9,8;G$(1)
3712 INPUT H$(1)
3714 PRINT AT 10,8;H$(1)
3716 INPUT I$(1)
3718 PRINT AT 11,22;I$(1)
3720 INPUT J$(1)
3722 PRINT AT 12,22;J$(1)
3724 INPUT K$(1)
3726 PRINT AT 13,22;K$(1)
3728 INPUT L$(1)
3730 PRINT AT 14,30;L$(1)
3732 INPUT M$(1)
3734 PRINT AT 15,25;M$(1)
3736 INPUT N$(1)
3738 PRINT AT 16,26;N$(1)
3740 INPUT O$(1)
3742 PRINT AT 17,27;O$(1)
3744 PRINT AT 20,0;"SEARCHING...
"
3746 PAUSE 200
3748 POKE 16437,255
3750 LET T=0
3752 FOR Q=1 TO N
3754 IF R$(Q,1 TO 4)=A$(4) OR R$
(Q,5)=B$(1) OR R$(Q,7)=D$(1) OR
R$(Q,8)=E$(1) OR R$(Q,10 TO 12)=
F$(1) OR R$(Q,14 TO 16)=G$(1) OR
R$(Q,18 TO 20)=H$(1) OR R$(Q,22
)=I$(1) OR R$(Q,23)=J$(1) OR R$(
Q,24)=K$(1) OR R$(Q,26 TO 27)=L$
(1) OR R$(Q,28)=M$(1) OR R$(Q,29
 TO 30)=N$(1) OR R$(Q,32)=O$(1)
THEN GOTO 3764
3756 NEXT Q
3758 CLS
3760 PRINT AT 10,5;"NO RECORD FO
UND"
3761 PRINT AT 4,1;"LAST DISPLAY
WAS NO. ";T
3762 GOTO 3776
3764 LET T=T+1
3766 CLS
3768 PRINT
3770 PRINT TAB 10;"RECORD NO. ";
Q
3772 PRINT AT 4,0;"DISPLAY NO. "
;T
3774 PRINT AT 12,0;R$(Q,1 TO 4);
R$(Q,5);C$;R$(Q,7);R$(Q,8);C$;R$
(Q,10 TO 12);C$;R$(Q,14 TO 16);C
$;R$(Q,18 TO 20);C$;R$(Q,22);R$(
Q,23);R$(Q,24);C$;R$(Q,26 TO 27)
;R$(Q,28);R$(Q,29 TO 30);C$;R$(Q
,32)
3776 PRINT AT 20,0;"PRESS NEWLIN
E FOR ANOTHER RECORD"
3778 PRINT AT 21,6;"OR M FOR MEN
U"
3780 INPUT Z$
3782 IF Z$=" " THEN GOTO 3756
3784 IF Z$="M" THEN GOTO 120
3786 GOTO 3780
4000 CLS
4010 PRINT AT 5,0;"PROGRAM TAKES
 ";PEEK 16396+256*PEEK 16397-165
09;" BYTES."
4020 PRINT AT 8,0;"VARIABLES TAK
E ";PEEK 16404+256*PEEK 16405-PE
EK 16400-256*PEEK 16401;" BYTES.
"
4030 PRINT AT 11,0;"DISPLAY TAKE
S ";PEEK 16400+256*PEEK 16401-PE
EK 16396-256*PEEK 16397;" BYTES.
"
4040 PRINT AT 14,0;"YOU HAVE ";P
EEK 16386+256*PEEK 16387-PEEK 16
412-256*PEEK 16413;" BYTES STILL
AVAILABLE."
4100 PAUSE 1000
4200 POKE 16437,255
4300 GOTO 120
5000 CLS
5010 PRINT AT 2,0;"ENTRY OF RECO
RD NUMBER ";RN
5020 PRINT AT 4,0;"TOMB NO. ";
5030 INPUT A$(1)
5031 IF A$(1)<="0000" OR A$(1)>"
9999" THEN GOTO 5030
5035 PRINT A$(1)
5040 PRINT "SIZE GROUP ";
5045 INPUT B$(1)
5046 IF B$(1)="A" OR B$(1)="B" O
R B$(1)="C" OR B$(1)="-" THEN GO
TO 5050
5047 GOTO 5045
5050 PRINT B$(1)
5055 PRINT "CONDITION ";
5060 INPUT D$(1)
5061 IF D$(1)="I" OR D$(1)="V" O
R D$(1)="-" THEN GOTO 5065
5062 GOTO 5060
5065 PRINT D$(1)
5070 PRINT "SHAPE ";
5075 INPUT E$(1)
5076 IF E$(1)="R" OR E$(1)="C" O
R E$(1)="O" OR E$(1)="-" THEN GO
TO 5080
5077 GOTO 5075
5080 PRINT E$(1)
5085 PRINT "LENGTH ";
5090 INPUT F$(1)
5091 IF F$(1)="---" THEN GOTO 50
95
5093 IF F$(1)<="000" OR F$(1)>"9
99" THEN GOTO 5090
5095 PRINT F$(1)
5100 PRINT "WIDTH ";
5105 INPUT G$(1)
5106 IF G$(1)="---" THEN GOTO 51
10
5107 IF G$(1)<="000" OR G$(1)>"9
99" THEN GOTO 5105
5110 PRINT G$(1)
5115 PRINT "DEPTH ";
5120 INPUT H$(1)
5121 IF H$(1)="---" THEN GOTO 51
25
5122 IF H$(1)<="000" OR H$(1)>"9
99" THEN GOTO 5120
5125 PRINT H$(1)
5130 PRINT "BODY-HEAD POINTING?
";
5135 INPUT I$(1)
5136 IF I$(1)="N" OR I$(1)="E" O
R I$(1)="S" OR I$(1)="W" OR I$(1
)="-" THEN GOTO 5140
5137 GOTO 5135
5140 PRINT I$(1)
5145 PRINT "BODY-SIDE ON? ";
5150 INPUT J$(1)
5151 IF J$(1)="R" OR J$(1)="L" O
R J$(1)="-" THEN GOTO 5155
5152 GOTO 5150
5155 PRINT J$(1)
5160 PRINT "BODY-HEAD FACING? ";
5165 INPUT K$(1)
5166 IF K$(1)="N" OR K$(1)="E" O
R K$(1)="S" OR K$(1)="W" OR K$(1
)="-" THEN GOTO 5170
5167 GOTO 5165
5170 PRINT K$(1)
5175 PRINT "BODY-AGE IN YEARS OR
 APPROX.? ";
5179 INPUT L$(1)
5180 IF L$(1)="0A" OR L$(1)="YA"
 OR L$(1)="MA" OR L$(1)="?A" OR
L$(1)="-" THEN GOTO 5186
5181 IF L$(1)>"A" THEN GOTO 5179
5182 IF L$(1)>"99" OR L$(1)<"00"
 THEN GOTO 5179
5183 IF L$(1)>="00" OR L$(1)<="9
9" THEN GOTO 5186
5186 PRINT L$(1)
5190 PRINT "BODY-SEX OR IF CHILD
";
5195 INPUT M$(1)
5196 IF M$(1)="M" OR M$(1)="F" O
R M$(1)="C" OR M$(1)="-" THEN GO
TO 5200
5197 GOTO 5195
5200 PRINT M$(1)
5205 PRINT "NUMBER OF OBJECTS FO
UND ";
5210 INPUT N$(1)
5211 IF N$(1)<"00" OR N$(1)>"99"
 THEN GOTO 5210
5215 PRINT N$(1)
5220 PRINT "WOODEN OR CLAY COFFI
N ";
5225 INPUT O$(1)
5226 IF O$(1)="Y" OR O$(1)="N" T
HEN GOTO 5230
5227 GOTO 5225
5230 PRINT O$(1)
5400 PRINT AT 19,0;"IS THIS CORR
ECT, Y OR N?"
5420 INPUT Z$
5430 IF Z$="N" THEN GOTO 5570
5440 IF Z$="Y" THEN GOTO 5460
5450 GOTO 5420
5460 LET R$(RN,1 TO 4)=A$(1)
5461 LET R$(RN,5)=B$(1)
5462 LET R$(RN,7)=D$(1)
5463 LET R$(RN,8)=E$(1)
5464 LET R$(RN,10 TO 12)=F$(1)
5465 LET R$(RN,14 TO 16)=G$(1)
5466 LET R$(RN,18 TO 20)=H$(1)
5467 LET R$(RN,22)=I$(1)
5468 LET R$(RN,23)=J$(1)
5469 LET R$(RN,24)=K$(1)
5470 LET R$(RN,26 TO 27)=L$(1)
5471 LET R$(RN,28)=M$(1)
5472 LET R$(RN,29 TO 30)=N$(1)
5473 LET R$(RN,32)=O$(1)
5540 PRINT AT 19,0;"RECORD HAS B
EEN ADDED TO FILE"
5550 LET RN=RN+1
5560 RETURN
5570 CLS
5580 PRINT AT 19,0;"ENTRY CANCEL
LED"
5590 RETURN
9300 LET OK=0
9310 IF X$(1)=" " THEN RETURN
9320 FOR I=1 TO 4
9330 IF X$(I)=" " OR X$(I)<="9"
AND X$(I)>="0" THEN GOTO 9350
9340 RETURN
9350 NEXT I
9360 LET VN=VAL X$
9370 IF VN>N OR VN=0 THEN RETURN

9380 LET OK=1
9390 RETURN
9400 STOP
9500 SAVE "CEMETERIES"
9500 GOTO 120
```

Graphics line notes

Enter the following line texts in inverse form:

1: RUN ONLY TO START A FILE OTHERWISE JUST ENTER GOTO 120.
2520: TOMB NUMBER:
2522: SIZE GROUP:
2524: CONDITION:
2526: SHAPE:
2528: LENGTH:
2530: WIDTH:
2532: DEPTH:
2534: BODY-HEAD POINTING:
2536: BODY-SIDE ON:
2538: BODY-HEAD FACING:
2540: BODY-AGE IN YEARS OR APPROX.:
2542: BODY-SEX OR IF CHILD:
2544: NUMBER OF OBJECTS FOUND:
2546: WOODEN OR CLAY COFFIN:

These texts except for line 1 are repeated in lines 3530 to 3660 and lines 5020, 5040, 5055, 5070, 5085, 5100, 5115, 5130, 5145, 5160, 5175, 5190, 5205, 5220.

8K ROM; 16K RAM

A Small Business Payroll Program

Alan Pattison

Every business with paid employees has the complicated task of doing its payroll. The program in this article will provide accurate payroll information for up to 35 employees. If the number of employees is greater then 35, the list can be broken down into shorter lists and the results combined where needed.

When the program is activated, the names of the employees are typed in and the pertinent employment information is entered. Then for each pay period, the hours worked by each employee are entered. The computer will then provide a detailed payroll list indicating: 1) each employee's gross pay, 2) itemized deductions withheld, and 3) the employee's net pay.

It also provides a payroll summary of total wages, itemized deductions, and net wages, as well as an "employer cost list." The latter not only lists the gross wages paid to each employee but also enumerates the fringe benefits paid by the employer. This gives the total cost to the employer for each employee for that pay period.

A routine is included for calling up any individual employee's record and making changes if necessary. New employees may be added without destroying the records of those already listed.

Lines 1000-1300 contain the routine for computing monthly U.S. withholding taxes. The routine listed is for the period ending July 1983 on a monthly payroll basis. You will need to change it when a new withholding tax table becomes effective, or if your payroll period is other than monthly. Circular E of the Internal Revenue Service includes tables for the percentage method of withholding. Refer to it if you need to make any changes. Use the listed routine as the format for your changes.

Alan Pattison, 3422 French Loop NW, Olympia, WA 98502.

Multi-line print statements under one list number are purposely entered as such; e.g., lines 720, 900, and 4050. In running an employee's record, since it can be confusing to have part of the record at the bottom on the screen, enter "CONTinue," and have the balance at the top of the next screen. By putting the employee's entire multi-line print statement after one line number, the screen will repeat the entire record on the next screen if it is cut short. (You can accomplish the same thing entering several line numbers with shorter print statements by entering a semi-colon (;) at the end of each line and starting each line with a TAB. However, memory is tight in this program so you might have to eliminate some frills to do it.)

Once you have entered the entire listing, RUN it, and the menu will appear. Enter menu item #9 (Exit Program) and SAVE it on tape. After you have SAVEd it, the menu will appear on the screen again. Enter menu item #10 and your listing 5000-6100 will be on the screen. These lines consist of LET statements for variables relating to employee deductions and benefits provided by employer. (A GOSUB/RETURN loop runs through them when you start a new employee list. They should be changed to fit your requirements. In the program as set up these variables represent the following:

SDI—State Disability Insurance (amount employee is assessed against each hour worked.)

IA—Industrial Accident (amount employer is assessed against each hour employee works.

FICA—Social Security (percentage applied against employee's gross wage to compute amount of social security he pays. Employer pays the same amount.)

XMT—Amount Internal Revenue allows for each dependent in computing withholding tax.

HI—Health Insurance (premium paid by employer for each employee).

RET—Retirement (percentage of gross salary paid by employer toward an employee's retirement fund).

RETX—Retirement (percentage of gross salary deducted from employee toward his retirement fund).

Press C and ENTER to return to menu.

Menu Routines

1) Start New Employee List

This routine will ask you how many employees you have, then prompts you to type in each name (last name first), hourly pay, marital status, number of tax exemptions, and employment status. Employment status: 0—former employee, 1—currently working, 2—has reached maximum social security wages. (2 would not be entered until an employee's wages reach the maximum as explained below.)

2) See List of Employees

The computer will list each employee and the pertinent information you have entered.

3) Enter Working Hours

The computer will show each employee's name and hourly wage scale and ask for actual hours worked for each week in month. When you have entered them all, it will show each employee's gross wage, rate of pay, hours worked, each deduction, and the net pay.

4) See Payroll list

This is the payroll list as described in 3.

5) See/Change Employee Record

You are asked to enter the name of the employee (a few letters of the last name are usually sufficient.) The computer will then print everything you have entered for that employee plus all payroll computations. If you wish to change any of the data for that specific individual, you enter 3 after which you will be asked if you wish to change each datum (Y/N), one by one. If you respond with a Y, you will be asked to input the change. After changes have been made, the corrected employee's record will be produced.

If you change an employee's status to 2, you are indicating he has reached the maximum salary on which Social Security needs to be paid. The computer will ask you to enter the amount of the employee's wages for that month on which social security should be paid.

6) See Employer Costs

This routine will give each employee's name, gross pay, and all the additional benefits besides wages paid by the employer that month.

AARDVARK — THE ADVENTURE PLACE

ADVENTURES FOR OSI, TRS-80, TRS-80 COLOR, SINCLAIR, PET, VIC-20

ADVENTURES — Adventures are a unique form of computer game. They let you spend 30 to 70 hours exploring and conquering a world you have never seen before. There is little or no luck in Adventuring. The rewards are for creative thinking, courage, and wise gambling — not fast reflexes.

In Adventuring, the computer speaks and listens to plain English. No prior knowledge of computers, special controls, or games is required so everyone enjoys them—even people who do not like computers.

Except for Quest, itself unique among Adventure games, Adventures are non-graphic. Adventures are more like a novel than a comic book or arcade game. It is like reading a particular exciting book where you are the main character.

All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC.

TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players — This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players — This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

PRICE AND AVAILABILITY:

All adventures are $14.95 on tape except Earthquake and Haunted House which are $9.95. Disk versions are available on OSI and TRS-80 Color for $2.00 additional.

Please specify system on all orders

ALSO FROM AARDVARK — This is only a partial list of what we carry. We have a lot of other games (particularly for the TRS-80 Color and OSI), business programs, blank tapes and disks and hardware. Send $1.00 for our complete catalog.

AARDVARK - 80
2352 S. Commerce, Walled Lake, MI 48088
(313) 669-3110

VISA

master charge

Phone Orders Accepted 8:00 a.m. to 4:00 p.m. EST. Mon.-Fri.

TRS-80 COLOR **SINCLAIR** **OSI** **VIC-20**

7) Add an Employee

This routine first lists current employees, then asks for the name of the employee you wish to add, followed by all the other pertinent information. You end entries by typing RETURN.

8) Look at Payroll Summary

The summary includes the name of the pay period, total employees working, total hours worked, total gross wages, totals of each deduction, and the total net wages.

9) and 10) have already been discussed.

When you up-date the program for your own needs, keep in mind that the program as it is, with present DIM statements, has reserved most of the memory. If you need more memory, you could decrease the number of employees allowed by revising the DIM statements and FOR/NEXT loops. Or you could eliminate some of the frills which are not essential to the basic program.

The search routine (menu item #5) limits the name you enter to seven characters which should be adequate. If you have more than one identical name in your employ, you may want to raise this limit. You will have to free up some more memory as indicated in the preceding paragraph, then change line 1725.

Variables

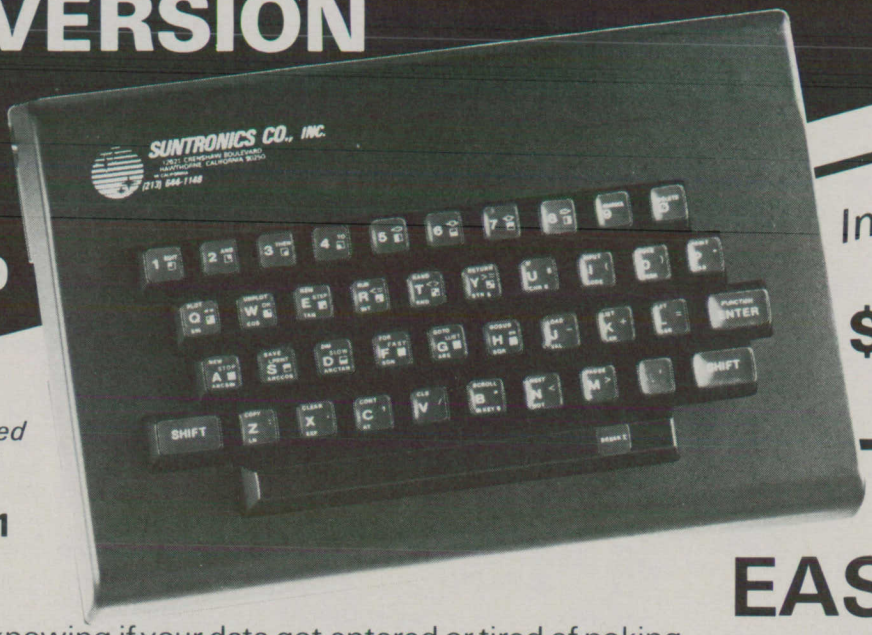
A$ —Name of employee
F$ —Payroll period
X$ —Graphic line S
Y$ —Graphic lind D
N —Employee number
H() —Hourly pay
M() —Marital status
X() —Tax exemptions
C() —Employment status
Q() —Week 1 hours
R() —Week 2 hours
S() —Week 3 hours
T() —Week 4 hours
U() —Week 5 hours
P() —Total hours for each employee
G() —Gross pay for each employee
W() —Gross pay less deductions for withholding exemptions
D() —State disability insurance withheld
F() —Social Security withheld
I() —U.S. withholding tax withheld
J() —Retirement withheld
Z() —Maximum FICA wage adjustment
SDI —Percentage for computing State Disability Insurance
FICA —Percentage for computing Social Security payment
XMT —Income tax deduction per exemption
HI —Health insurance premium paid by employer
RET —Percentage used to compute employer's share of retirement payment
RETX —Percentage used to compute employee's share of retirement payment
IA —Percentage used to compute Industrial Accident premium paid by employer
L —Cost per employee
LL —Total cost of employees
B(1) —Working variable to compute totals of categories
I$() —Variable used in search routine
C$ —Variable used in search routine

Working variables: A, J, E, Z, Y, K, M$, V, B$, GM

```
  10 REM "PAYROLL"
  11 LET X$="
  12 PRINT TAB 6;"
  14 PRINT TAB 6;"
  15 LET Y$="
  16 PRINT TAB 6;"  PAYROLL  REC
ORDS
  18 PRINT TAB 6;"
  20 PRINT TAB 6;"
  22 PRINT
  24 PRINT "DO YOU WISH TO:"
  28 PRINT "*";TAB 2;"1)START NE
W EMPLOYEE LIST?"
  29 PRINT TAB 2;"2)SEE LIST OF
EMPLOYEES?"
  30 PRINT "*";TAB 2;"3)ENTER WO
RKING HOURS?"
  32 PRINT TAB 2;"4)SEE PAYROLL
LIST?"
  34 PRINT TAB 2;"5)SEE/CHANGE E
MPLOYEE RECORD?"
  36 PRINT TAB 2;"6)SEE EMPLOYER
 COSTS?"
  38 PRINT TAB 2;"7)ADD AN EMPLO
YEE?"
  39 PRINT TAB 2;"8)LOOK AT PAYR
OLL SUMMARY?"
  40 PRINT TAB 2;"9)EXIT PROGRAM
?"
  45 PRINT " 10)CHANGE COMPUTATI
ON VARIABLES"
  46 PRINT
  47 PRINT "ENTER YOUR CHOICE, 1
 TO 10."
  48 PRINT AT 20,0;"*CAUTION-""1
"" AND ""3"" WILL ERASE PREVIOUS
 ENTRIES."
  50 INPUT A
  53 IF A=1 THEN GOTO 100
  55 IF A=2 THEN GOTO 300
  60 IF A=3 THEN GOTO 500
  65 IF A=4 THEN GOTO 800
  70 IF A=5 THEN GOTO 1700
  75 IF A=6 THEN GOTO 4000
  80 IF A=7 THEN GOTO 2800
  82 IF A=8 THEN GOTO 3400
  85 IF A=9 THEN GOTO 1500
  87 IF A=10 THEN CLS
  88 IF A=10 THEN LIST 5000
  90 STOP
  95 GOTO 10
 100 CLS
 105 PRINT Y$
 110 PRINT TAB 8;"EMPLOYEE RECOR
DS"
 115 PRINT X$
 120 GOSUB 5000
 122 LET F$=""
 125 PRINT "HOW MANY EMPLOYEES A
RE TO BE  PRINTED?"
 128 DIM Q(35)
 130 DIM A$(35,15)
 132 DIM R(35)
 133 DIM Z(35)
 135 DIM H(35)
 137 DIM S(35)
 140 DIM M(35)
 142 DIM T(35)
 145 DIM X(35)
 147 DIM U(35)
 149 DIM P(35)
 150 DIM C(35)
 151 INPUT N
 152 CLS
 154 PRINT X$
 155 FOR E=1 TO 35
 160 PRINT "NAME: ";
 165 INPUT A$(E)
 170 PRINT TAB 15;A$(E)
 175 PRINT "HOURLY PAY: ";
 180 INPUT H(E)
 185 PRINT TAB 15;H(E)
 190 PRINT "MARITAL STAT: ";
 195 INPUT M(E)
 200 PRINT TAB 15;M(E)
 205 PRINT "TAX EXEMPS: ";
 210 INPUT X(E)
 215 PRINT TAB 15;X(E)
 220 PRINT "EMPL. STATUS: ";
 225 INPUT C(E)
 230 PRINT TAB 15;C(E)
 232 LET J=E
 233 IF J=N THEN GOTO 300
 235 PRINT X$
 240 NEXT E
 300 CLS
 310 PRINT TAB 6;"
  320 PRINT TAB 6;"EMPLOYEE RECO
RDS
 330 PRINT TAB 6;"
 335 FOR E=1 TO 35
 340 GOSUB 700
 380 IF J=N THEN GOTO 400
 390 NEXT E
 400 PRINT X$
 410 PRINT "END OF FILE."
 420 PRINT
 430 PRINT "HIT ANY KEY TO RETUR
N TO START."
 440 LET M$=INKEY$
 441 IF M$="" THEN GOTO 440
 445 CLS
 450 GOTO 5
 500 CLS
 505 PRINT Y$
 510 PRINT TAB 10;"WAGE ENTRIES"
 515 PRINT X$
 516 PRINT "TYPE THE PAYROLL PER
IOD."
 517 INPUT F$
 518 PRINT "PERIOD: ";F$
 570 FOR E=1 TO 35
 575 IF C(E)=0 THEN LET P(E)=0
 577 IF C(E)=0 THEN GOTO 680
 578 PRINT X$
 580 PRINT E;TAB 4;A$(E);TAB 21;
"RATE: ";H(E)
 590 PRINT TAB 7;"WEEK 1 HRS: ";
 595 INPUT Q(E)
 600 PRINT Q(E)
 605 PRINT TAB 7;"WEEK 2 HRS: ";
 610 INPUT R(E)
 615 PRINT R(E)
 620 PRINT TAB 7;"WEEK 3 HRS: ";
 625 INPUT S(E)
 630 PRINT S(E)
 635 PRINT TAB 7;"WEEK 4 HRS: ";
 640 INPUT T(E)
 645 PRINT T(E)
 650 PRINT TAB 7;"WEEK 5 HRS: ";
 655 INPUT U(E)
 660 PRINT U(E)
 667 LET P(E)=Q(E)+R(E)+S(E)+T(E
)+U(E)
 670 PRINT TAB 7;"TOTAL:      ";
P(E)
 672 LET J=E
 673 IF J=N THEN GOTO 800
 680 NEXT E
 710 PRINT X$
 720 PRINT E;TAB 4;A$(E);TAB 20;
"STATUS: ";TAB 29;C(E);TAB 4;"HR
LY PAY: ";H(E);TAB 20;"MARITAL:
";M(E);TAB 4;"NO.EXEMPTIONS: ";X
(E)
 730 IF C(E)=0 THEN PRINT TAB 8;
"FORMER EMPLOYEE"
 750 LET J=E
 760 RETURN
 800 CLS
 810 PRINT TAB 10;"
 820 PRINT TAB 10;"  PAYROLL  "
 830 PRINT TAB 10;"
 845 PRINT "PERIOD: ";F$
 848 LET V=0
 850 DIM G(35)
 852 DIM J(35)
 855 DIM D(35)
 860 DIM F(35)
 865 DIM W(35)
 868 DIM I(35)
 870 FOR E=1 TO N
 872 IF C(E)=0 THEN GOTO 960
 875 PRINT X$
 880 LET G(E)=P(E)*H(E)
 885 LET D(E)=INT (100*(P(E)*SDI
)+.5)/100
```

FULL SIZE KEYBOARD CONVERSION

FOR YOUR ZX-81/ TS-1000



Introductory Priced At

$69.95

Fully Warranteed For 90 Days!

SUN KD-81

If your tired of not knowing if your data got entered or tired of poking data in with one or two fingers, then it's time to upgrade your ZX-81 to a full size, professional, keyboard. The **SUN KD-81 KEYBOARD** offers just that ... all the ease and comfort of inputting your programs and text on a **fast** and **efficient** professional sized keyboard!

KD-81 Features:

- Full Size Keyboard with 41 Keys
- Full Size Space Bar
- Allows Touch Typing
- Keyboard Case Holds Both Keyboard and Computer
- High Impact Plastic Case with Vaporized Metal Shielding
- Easy Assembly
- Two Color Imprinted Key Tops for Easy Reading
- Key Tops have Commands and Graphics Spelled Out for Easy Programming
- Measures 10¾" x 7¼" x 2⅛"

EASY TO INSTALL

- No Soldering
- No Modifications

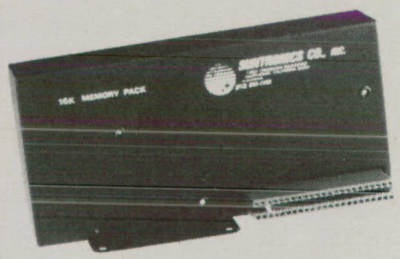
Check out these simple installation steps!

1. Remove 4 screws securing ZX-81 case and remove 2 screws holding ZX-81 PCB.
2. Unplug the 2 ribbon cables from the ZX-81 keyboard.
3. Plug the 2 ribbon cables into the connectors on the KD-81 keyboard.
4. Attach the ZX-81 PCB to the KD-81 case with 2 screws, close case and install remaining 4 screws into the bottom of the KD-81 Keyboard case ...

And enjoy the comfort and ease of inputting your data on a full size keyboard!

16K RAM Module

with "PIGGYBACK" Connector for those EXTRA ADD-ONS



- Steel Case instead of plastic reduces RFI
- RAM Module has lip for mounting on ZX-81 or our KD-81 keyboard that eliminates noise and crash problems due to the "wobbles"
- Built-in output connector for piggyback mounting additional peripherals
- Equivalent to ZX-81 or TS-1000 16K RAM in performance

MX-16 mounted on the ZX-81

All these features And still only..... **$49.95**

32K and 64K available..... CALL

SUNTRONICS CO., INC.

12621 Crenshaw Blvd., Hawthorne, CA 90250

STORE HOURS: MON.-FRI. 9:00am to 6:30pm
SATURDAY 10:00am to 5:00pm

CALIFORNIA **213-644-1149** (for Tech Info and Calif. orders)

OUTSIDE CALIFORNIA TOLL FREE **1-800-421-5775** (Order Desk Only)

Mail Order—Minimum Order: $10. Send Check or Money Order to: **P.O. BOX 1957—Dept. B, HAWTHORNE, CA 90250**. VISA or Mastercard (please include expiration date). Add $4.00 postage and handling to order. CA residents add 6% sales tax

```
 890 LET F(E)=INT (100*(G(E)*FIC
A)+.5)/100
 892 IF C(E)=2 THEN LET F(E)=Z(E
)
 893 LET J(E)=INT (100*(G(E)*RET
X)+.5)/100
 895 LET W(E)=G(E)-(XMT*X(E))
 898 GOSUB 1000
 899 IF U=E THEN RETURN
 900 PRINT E;TAB 4;A$(E);TAB 20;
"RATE: ";H(E);TAB 4;"HRS.: ";P(E)
;TAB 14;"GROSS PAY:$";TAB 25;G(E
);TAB 14;"S.D.I.: ";TAB 25;D(E);
TAB 14;"RETIRE.: ";TAB 25;J(E);TA
B 14;"F.I.C.A.: ";TAB 25;F(E);TA
B 14;"INC. TAX: ";TAB 25;I(E);TA
B 14;">NET PAY: ";TAB 25;G(E)-D(
E)-J(E)-F(E)-I(E)
 950 NEXT E
 952 PRINT X$
 955 PRINT "END OF LIST."
 970 PRINT "HIT ANY KEY TO RETUR
N TO START."
 975 LET M$=INKEY$
 978 IF M$="" THEN GOTO 975
 980 CLS
 985 GOTO 5
1005 IF M(E)=1 OR M(E)=3 THEN GO
TO 1200
1010 IF W(E)<200 THEN LET I(E)=0
1020 IF W(E)<506 AND W(E)>200 TH
EN LET I(E)=.12*(W(E)-200)
1030 IF W(E)<998 AND W(E)>506 TH
EN LET I(E)=36.72+.16*(W(E)-506)
1040 IF W(E)<1545 AND W(E)>998 T
HEN LET I(E)=115.44+.19*(W(E)-99
8)
1050 IF W(E)<1967 AND W(E)>1545
THEN LET I(E)=219.37+.24*(W(E)-1
545)
1060 IF W(E)<2408 AND W(E)>1967
THEN LET I(E)=320.65+.27*(W(E)-1
967)
1070 IF W(E)<2850 AND W(E)>2408
THEN LET I(E)=439.72+.32*(W(E)-2
408)
1075 IF W(E)>2850 THEN LET I(E)=
531.16+.37*(W(E)-2850)
1080 GOTO 1300
1200 IF W(E)<117 THEN LET I(E)=0
1210 IF W(E)<267 AND W(E)>117 TH
EN LET I(E)=.12*(W(E)-117)
1220 IF W(E)<742 AND W(E)>267 TH
EN LET I(E)=18+.18*(W(E)-267)
1230 IF W(E)<1042 AND W(E)>742 T
HEN LET I(E)=94+.20*(W(E)-742)
1240 IF W(E)<1408 AND W(E)>1042
THEN LET I(E)=154+.24*(W(E)-1042
)
1250 IF W(E)<1875 AND W(E)>1408
THEN LET I(E)=241.84+.30*(W(E)-1
408)
1260 IF W(E)<2317 AND W(E)>1875
THEN LET I(E)=381.94+.34*(W(E)-1
875)
1270 IF W(E)>2317 THEN LET I(E)=
532.22+.37*(W(E)-2317)
1300 LET I(E)=INT (100*I(E)+.5)/
100
1310 RETURN
1500 CLS
1510 PRINT "YOU HAVE INDICATED Y
OU WISH TO  EXIT THIS PROGRAM."
1520 PRINT
1530 PRINT "IF YOU HAVE MADE ANY
 CHANGES--"
1540 PRINT
1550 PRINT "┌──────────────────
──┐"
1560 PRINT "│ DO NOT FORGET TO RE
-LOAD TAPE │"
1570 PRINT "└──────────────────
──┘"
1580 PRINT
1590 PRINT "TO SAVE THIS PROGRAM
 AS CHANGED PREPARE THE TAPE REC
ORDER, BEGINRECORDING, AND TYPE
""C"".."
1600 STOP
1610 SAVE "PAYROL"
1620 GOTO 5
1700 CLS
1705 PRINT "TYPE NAME OF EMPLOYE
E (LAST NAMEFIRST):"
1710 INPUT C$
1715 CLS
1720 LET K=LEN C$
1725 IF K>7 THEN LET K=7
1730 DIM I$(35,K)
1740 FOR E=1 TO N
1750 LET I$(E)=A$(E)
1755 LET C$=C$( TO K)
1760 IF C$=I$(E) THEN GOTO 1800
1770 NEXT E
1775 PRINT X$
1780 PRINT "NO SUCH NAME. DID YO
U SPELL IT  RIGHT?"
1782 PRINT X$
1785 PRINT "TYPE ""1"" TO TRY AG
AIN, ""2"" TO  RETURN TO START."
1786 INPUT L
1787 CLS
1788 IF L=1 THEN GOTO 1700
1789 GOTO 5
1800 PRINT X$
1805 PRINT E;TAB 4;A$(E);TAB 20;
"STATUS.: ";TAB 29;C(E)
1810 PRINT TAB 4;"HRLY PAY: ";H(
E);TAB 20;"MARITAL: ";M(E)
1820 PRINT TAB 4;"NO. EXEMPTIONS
: ";X(E)
1825 IF C(E)=0 THEN PRINT TAB 8;
"FORMER EMPLOYEE"
1830 IF C(E)=0 THEN GOTO 1960
1832 PRINT "PERIOD: ";F$
1840 PRINT TAB 7;"WEEK 1 HRS: ";
Q(E)
1850 PRINT TAB 7;"WEEK 2 HRS: ";
R(E)
1860 PRINT TAB 7;"WEEK 3 HRS: ";
S(E)
1870 PRINT TAB 7;"WEEK 4 HRS: ";
T(E)
1880 PRINT TAB 7;"WEEK 5 HRS: ";
U(E)
1890 PRINT TAB 7;">TOTAL:      ";
P(E)
1900 PRINT
1910 PRINT TAB 7;"GROSS PAY:";TA
B 18;"$";P(E)*H(E)
1920 PRINT TAB 7;"S.D.I.:";TAB 1
9;D(E)
1925 PRINT TAB 7;"RETIREMENT:";T
AB 19;J(E)
1930 PRINT TAB 7;"F.I.C.A.:";TAB
 19;F(E)
1940 PRINT TAB 7;"INC. TAX:";TAB
 19;I(E)
1950 PRINT TAB 7;">NET PAY:";TAB
 19;G(E)-D(E)-J(E)-F(E)-I(E)
1960 PRINT X$
1970 PRINT "TYPE ""1"" TO LOOK A
T ANOTHER"
1980 PRINT "EMPLOYEE RECORD, ""2
"" TO RETURN  TO START, ""3"" TO
 CHANGE DATA."
1990 LET M$=INKEY$
1992 IF M$="" THEN GOTO 1990
1995 CLS
2000 IF M$="1" THEN GOTO 1700
2010 IF M$="3" THEN GOTO 2500
2020 GOTO 5
2500 CLS
2510 PRINT "YOU WISH TO CHANGE D
ATA ON";TAB 8;A$(E)
2515 PRINT X$
2530 FOR V=E TO E
2552 PRINT "WANT TO CHANGE NAME?
(Y/N)"
2555 LET M$=INKEY$
2556 IF M$="" THEN GOTO 2555
2557 IF M$<>"Y" THEN GOTO 2569
2559 CLS
2560 PRINT "NAME: ";
2565 INPUT A$(V)
2567 PRINT A$(V)
2569 PAUSE 50
2570 PRINT "CHANGE EMPLOYMENT ST
ATUS? (Y/N)"
2575 LET M$=INKEY$
2580 IF M$="" THEN GOTO 2575
2585 IF M$<>"Y" THEN GOTO 2594
2588 PRINT TAB 2;"-ENTER EMPLOYM
ENT STATUS: ";
2590 INPUT C(V)
2591 PRINT C(V)
2593 IF C(V)=2 THEN GOSUB 4500
2594 PAUSE 50
2595 PRINT "CHANGE HOURLY PAY? (
Y/N)"
2596 LET M$=INKEY$
2597 IF M$="" THEN GOTO 2596
2598 IF M$<>"Y" THEN GOTO 2604
2599 PRINT TAB 2;"-ENTER HOURLY
PAY: ";
2500 INPUT H(V)
2502 PRINT H(V)
2504 PAUSE 50
2505 PRINT "CHANGE MARITAL STATU
S? (Y/N)"
2506 LET M$=INKEY$
2507 IF M$="" THEN GOTO 2506
2508 IF M$<>"Y" THEN GOTO 2619
2510 PRINT TAB 2;"-ENTER MARITAL
 STATUS: ";
2515 INPUT M(V)
2518 PRINT M(V)
2519 PAUSE 50
2620 PRINT "CHANGE TAX EXEMPTION
S? (Y/N)"
2621 LET M$=INKEY$
2622 IF M$="" THEN GOTO 2621
2623 IF M$<>"Y" THEN GOTO 2635
2625 PRINT TAB 2;"-ENTER TAX EXE
MPTIONS: ";
2630 INPUT X(V)
2634 PRINT X(V)
2635 PAUSE 50
2636 PRINT "CHANGE HOURS WORKED?
 (Y/N)"
2637 LET M$=INKEY$
2638 IF M$="" THEN GOTO 2637
2639 IF M$<>"Y" THEN GOTO 2717
2640 PRINT
2641 PRINT "YOU MUST MAKE AN ENT
RY FOR EACH WEEK, EVEN IF ""0"",
"
2642 PRINT TAB 2;"-ENTER WEEK 1
HRS: ";
2645 INPUT Q(V)
2650 PRINT Q(V)
2655 PRINT TAB 2;"-ENTER WEEK 2
HRS: ";
2660 INPUT R(V)
2670 PRINT R(V)
2675 PRINT TAB 2;"-ENTER WEEK 3
HRS: ";
2680 INPUT S(V)
2685 PRINT S(V)
2690 PRINT TAB 2;"-ENTER WEEK 4
HRS: ";
2692 INPUT T(V)
2695 PRINT T(V)
2700 PRINT TAB 2;"-ENTER WEEK 5
HRS: ";
2705 INPUT U(V)
2710 PRINT U(V)
2715 LET P(V)=Q(V)+R(V)+S(V)+T(V
)+U(V)
2716 LET P(E)=P(V)
2717 CLS
2718 GOSUB 880
2720 GOTO 1800
2500 CLS
2805 PRINT Y$
2810 PRINT TAB 9;"EMPLOYEE LIST"
2830 FOR E=1 TO 50
2835 GOSUB 700
2880 IF J=N THEN GOTO 2900
2895 NEXT E
2900 PRINT X$
2910 PRINT "WHEN YOU WISH TO END
 NEW ENTRIESTYPE ""RETURN""."
3000 LET E=E+1
3010 LET N=E
3020 PRINT X$
3030 PRINT E;TAB 4;"NAME: ";
3040 INPUT B$
3045 PRINT B$
3050 LET A$(E)=B$
3060 IF B$="RETURN" THEN GOTO 32
00
3070 PRINT TAB 4;"EMPL. STATUS:
";
3075 INPUT C(E)
3080 PRINT C(E)
3085 PRINT TAB 4;"HOURLY PAY: ";
3090 INPUT H(E)
3095 PRINT H(E)
3100 PRINT TAB 4;"MARITAL STATUS
: ";
3110 INPUT M(E)
3120 PRINT M(E)
3130 PRINT TAB 4;"TAX EXEMPTIONS
: ";
3140 INPUT X(E)
3150 PRINT X(E)
3160 GOTO 3000
3200 LET N=E-1
3205 CLS
3210 GOTO 5
3400 CLS
```

```
        PAYROLL  RECORDS

DO YOU WISH TO:
  1)START NEW EMPLOYEE LIST?
  2)SEE LIST OF EMPLOYEES?
  3)ENTER WORKING HOURS?
  4)SEE PAYROLL LIST?
  5)SEE/CHANGE EMPLOYEE RECORD?
  6)SEE EMPLOYER COSTS?
  7)ADD AN EMPLOYEE?
  8)LOOK AT PAYROLL SUMMARY?
  9)EXIT PROGRAM?
 10)CHANGE COMPUTATION VARIABLES

ENTER YOUR CHOICE, 1 TO 10.

*CAUTION-"1" AND "3" WILL ERASE
PREVIOUS ENTRIES.
```

```
          PAYROLL
PERIOD: 2/1/83 TO 2/28/83

1    JOHN DOE          RATE:  5
     HRS.:160    GROSS PAY:$800
                 S.D.I.:    4.91
                 RETIRE.:   40
                 F.I.C.A.:  53.6
                 INC. TAX:  76.61
                 >NET PAY:  624.88

2    JOHN SMITH        RATE:  10
     HRS.:140    GROSS PAY:$1400
                 S.D.I.:    4.3
                 RETIRE.:   70
                 F.I.C.A.:  93.8
                 INC. TAX:  175.99
                 >NET PAY:  1055.91

END OF LIST.
```

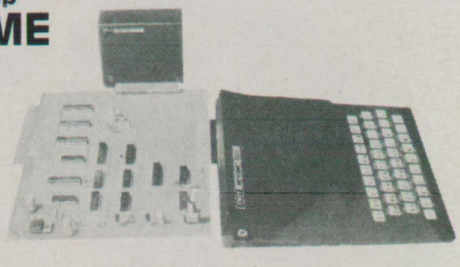
```
      PAYROLL SUMMARY
PERIOD: 2/1/83 TO 2/28/83

TOTAL EMPLOYEES WORKING: 2
TOTAL HOURS WORKED: 300

TOTAL GROSS WAGES: 2200

TOTAL S.D.I.:  9.21
TOTAL RETIREMENT:  110
TOTAL F.I.C.A.:  147.4
TOTAL INCOME TAX:  252.6

TOTAL NET WAGES:  1680.79

HIT ANY KEY TO RETURN TO START.
```

```
3410 PRINT TAB 7;"
"
3420 PRINT TAB 7;"  PAYROLL SUMMA
RY  "
3430 PRINT TAB 7;"
"
3440 PRINT Y$
3450 PRINT "PERIOD: ";F$
3460 PRINT X$
3500 DIM B(1)
3505 FOR E=1 TO N
3510 LET B(1)=B(1)+1
3515 IF C(E)=0 THEN LET B(1)=B(1
)-1
3520 NEXT E
3530 PRINT "TOTAL EMPLOYEES WORK
ING: ";B(1)
3540 DIM B(1)
3545 FOR E=1 TO N
3550 IF C(E)=0 THEN GOTO 3570
3560 LET B(1)=B(1)+P(E)
3570 NEXT E
3580 PRINT "TOTAL HOURS WORKED:
";B(1)
3590 DIM B(1)
3600 FOR E=1 TO N
3610 LET B(1)=B(1)+G(E)
3620 NEXT E
3625 PRINT Y$
3630 PRINT "TOTAL GROSS WAGES: "
;B(1)
3640 DIM B(1)
3650 FOR E=1 TO N
3660 LET B(1)=B(1)+D(E)
3670 NEXT E
3675 PRINT X$
3680 PRINT "TOTAL S.D.I.: ";B(1)
3681 DIM B(1)
3682 FOR E=1 TO N
3685 LET B(1)=B(1)+J(E)
3687 NEXT E
3688 PRINT "TOTAL RETIREMENT: ";
B(1)
3690 DIM B(1)
3700 FOR E=1 TO N
3710 LET B(1)=B(1)+F(E)
3720 NEXT E
3730 PRINT "TOTAL F.I.C.A.: ";B(
1)
3740 DIM B(1)
3750 FOR E=1 TO N
3760 LET B(1)=B(1)+I(E)
3770 NEXT E
3780 PRINT "TOTAL INCOME TAX: ";
B(1)
3790 DIM B(1)
3800 FOR E=1 TO N
3810 LET B(1)=B(1)+G(E)-D(E)-J(E
)-F(E)-I(E)
3820 NEXT E
3825 PRINT Y$
3830 PRINT "TOTAL NET WAGES: ";B
(1)
3840 PRINT X$
3900 PRINT "HIT ANY KEY TO RETUR
N TO START."
3910 LET M$=INKEY$
3915 IF M$="" THEN GOTO 3910
3920 CLS
3930 GOTO 5
4000 CLS
4010 PRINT Y$
4020 PRINT TAB 9;"EMPLOYER COSTS
"
4030 LET LL=0
4040 FOR E=1 TO N
4045 IF C(E)=0 THEN GOTO 4090
4048 PRINT X$
4050 PRINT E;TAB 4;A$(E);TAB 4;"
GROSS WAGE:";TAB 20;"$";G(E);TAB
 4;"FICA";TAB 21;F(E);TAB 4;"IND
. ACCIDENT";TAB 21;INT (100*(P(E
)*IA)+.5)/100;TAB 4;"HEALTH INS.
";TAB 21;HI;TAB 4;"RETIREMENT";T
AB 21;INT (100*(G(E)*RET)+.5)/10
0
4060 LET L=G(E)+F(E)+(P(E)*IA)+H
I+(G(E)*RET)
4065 LET L=INT (L*100+.5)/100
4070 LET LL=LL+L
4080 PRINT TAB 4;"TOTAL";TAB 20
;"$";L
4085 GOSUB 5050
4090 NEXT E
4100 PRINT Y$
4110 PRINT "TOTAL COSTS:";TAB 20
;"$";LL
4120 PRINT X$
4130 PRINT "HIT ANY KEY TO RETUR
N TO START."
4140 LET M$=INKEY$
4145 IF M$="" THEN GOTO 4140
4150 CLS
4160 GOTO 5
4500 PRINT Y$
4510 PRINT "STATUS 2 INDICATES T
HAT EMPLOYEEWAGE THIS PERIOD EXC
EEDS SOCIAL SECURITY MAXIMUM. EN
TER AMOUNT OF WAGE SUBJECT TO S
OC. SEC. FOR";A$(V)
4515 PRINT X$
4520 INPUT GM
4530 LET Z(V)=INT (100*(GM*FICA)
+.5)/100
4550 RETURN
5010 LET SDI=.0307
5020 LET IA=.0818
5030 LET FICA=.067
5040 LET XMT=83.33
5050 LET HI=80
5060 LET RET=.07
5070 LET RETX=.05
6000 RETURN
6010 REM ENTER "C" TO RETURN TO
MENU
```


Get on the Control Bus for only $59.95 round trip . . . and be on TIME

Compatible with ZX80/81
MicroAce & TIMEX™ 1000

8 lines departing
(outputs capable of driving relays)
8 lines arriving
(TTL COMPATIBLE INPUTS)



I/O Board with our Real Time Clock/Calendar

Time	Month	Date	Year	Day of Week
23:59:59	12	31	99	7

Features
- 12/24 hour format
- Battery back-up for clock
- ±30 second time correction
- Leap year correction

Comes Complete With
- All software needed to operate clock and Input/Output ports
- Expandable ports
- Feed through Sinclair Bus connector to allow normal expansion
- I/0 ports and other controls mate with Radio Shack™ 44 pin edge socket
- 90 day warranty

Future Products
- Touch Tone™ encoder/decoder
- Speech and Sound synthesizer

All accessories can be connected together and separately controlled from the I/0 Ports

MODEL Built & Tested	MODEL Bare PCB & Manual	DESCRIPTION	PRICE
310	315	MASTER I/O WITH CLOCK	$59.95 $24.95
MODEL 310 ACCESSORY BOARDS			
320	325	A to D and D to A converter	$47.95 $19.95
330		Wireless control system (BSR™)	$69.95
340		Solid State AC Relay	$19.95
SPECIALIZED PARTS FOR MODEL 315			
316		Sinclair edge connector, 46 pin w/key	$12.95
317		Clock IC and crystal (tested)	$ 4.95

California residents add 6% Shipping and handling $ 3.95

Send self addressed stamped envelope for catalog.

VISA MasterCard

J K AUDIO
P.O. Box 3295
Escondido, CA.92025-0580
(619) 741-5132 (24 Hr. Order Line)

CYBORGWARS

NOT ANOTHER TOY

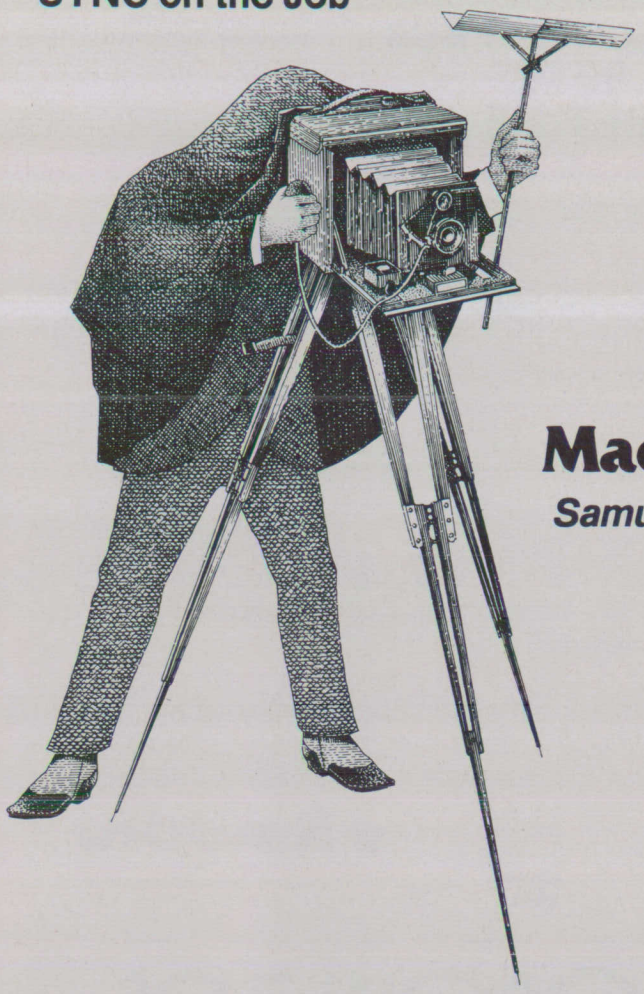
BUT A COMPLEX SIMULATION OF FOUR MILITARY-INDUSTRIAL ECONOMIES LOCKED IN A DEADLY STRUGGLE FOR SURVIVAL. ONE TO FOUR PLAYERS COMPETE WITH EACH OTHER AND/OR THE COMPUTER. BALANCE OF POWER DEPENDS UPON SKILL IN DEVELOPING RESOURCES, USE OF ESPIONAGE, EXPLOITATION OF ALLIANCES, AND UTILIZATION OF MILITARY POTENTIAL. REQUIRES ZX81 WITH 8K ROM AND 16K RAM.

ORDER FORM FOR CYBORGWARS

Send $14 (plus $1 for shipping) to: STRATAGEM CYBERNETICS, INC., 286 Corbin Place, 2E, Brooklyn, New York 11235.

NAME _____
ADDRESS _____ CITY _____
STATE _____ ZIP _____

8K ROM; 2K RAM



Macro Photo

Samuel Giannavola

The Sinclair ZX81 can be a very powerful tool in the work place where a person is dealing with variables which are to be used in mathematical formulas. The computer will give reliable output data which can be quickly used.

For example, a painter needs to know how much paint to purchase for a particular job. A program could be written in which the input data would include the dimensions of the space to be painted and the recommended coverage a particular type of paint has. The ZX81 would deterermine the total footage and output the number of gallons of paint that would be needed. Numerous other examples will occur to the reader.

This article gives a detailed description of one such practical work related application.

Photographers who do close-up or macro photography using non-automatic cameras face a formidable challenge in determining proper exposure, how far the subject should be from the lens, and how far the lens should be extended away from the film plane. In order to do this in a planned and orderly manner, the careful photographer would have to make mathematical computations using at least three formulas and consult at least one chart.

Samuel Giannavola, University of Illinois, College of Veterinary Medicine, Biomedical Communications Center, 1102 West Hazelwood Dr., 206 Large Animal Clinic, Urbana, IL 61801.

Figure 1.

F = focal length of lens
O = distance object from lens
I = distance image from lens
R = scale of reproduction
ME = metered exposure time
AE = adjusted exposure time
R = I/O
O = (F/R)+F
I = (F*R)+F
AE = ME*(I*I/F*F)

The formulas would use as input the desired size on the negative from a subject of a given size, what the exposure time at the subject would be, and the type of film used (See Figure 1). A photographer armed with the formulas in front of him and an electronic calculator would take about five minutes to arrive at what his final exposure should be and what the subject distance and lens to film distance should be to give the magnification he desires.

Well, photographers are, by their nature, not very patient people when it comes to paper work, so this program will allow the photographer to input the data which the ZX81 will use to figure the adjusted exposure time (for bellows length and reciprocity), the proper subject to lens distance, and the proper film to lens distance for a given image magnification.

The Sinclair is small and mobile enough to fit even in the smallest of studios, yet it can be used in a number of applications in photography. Among these are: (1) figure exact negative to print magnifications; (2) convert metric to English measurements. (3) Calculate the percent solution for various photographic solutions. (4) Guide filter selection for black and white and color printing.

Of course, the big advantage the computer has over traditional methods of figuring the above mentioned items is speed and accuracy. The calculations involved in the "Macro Photo" Program can take many minutes to figure, but once the program is LOADed, the computer can supply an answer in less than five seconds. For a group of people who measure time in fractions of a second, the speed of the computer makes it a tool of great advantage to the photographer. ■

```
  1 REM "MACRO PHOTO"
 10 PRINT "WHAT IS THE FOCAL LE
NGTH OF YOUR LENS (MM)?"
 20 INPUT F
 25 PRINT F
 30 PRINT "HOW LONG IS YOUR SUB
JECT?"
 40 INPUT OL
 45 PRINT OL
 50 PRINT "HOW LONG DO YOU WANT
 THE IMAGE  TO BE?"
 60 INPUT IL
 61 PRINT IL
 62 PRINT "WHAT IS YOUR METERED
 EXPOSURE TIME (SEC.)?"
 63 INPUT ME
 64 PRINT ME
 65 PRINT "ARE YOU USING EPR OR
 B/W FILM?"
 66 INPUT A$
 70 LET R=0
 80 LET O=0
 90 LET I=0
 95 LET AE=ME
100 LET R=IL/OL
110 LET I=(F*R)+F
120 LET O=(F/R)+F
121 IF O>=8*F THEN GOTO 130
125 LET AE=ME*((I*I)/(F*F))
126 GOSUB 1000
130 PRINT "SCALE OF REPRODUCTIO
N=";R;"X"
140 PRINT "BELLOWS LENGTH=";I;"
 MM"
150 PRINT "SUBJECT TO LENS DIST
ANCE=";O;" MM"
160 PRINT "ADJUSTED EXPOSURE TI
ME IS ";AE;" SEC."
200 STOP
1000 IF A$="B/W" THEN GOTO 2000
1010 IF AE<=1 THEN GOTO 3000
1020 IF AE>1 AND AE<=100 THEN GO
TO 1050
1030 PRINT "********ADJUSTED EXP
OSURE EXCEEDS RECCOMMENDATIONS**
********"
1040 GOTO 3000
1050 LET AE=AE*1.5
1060 PRINT "PLUS CC 10 B"
1070 GOTO 3000
2000 IF AE<.1 THEN GOTO 3000
2010 IF AE>=1 AND AE<=10 THEN GO
TO 2500
2020 IF AE>=10 AND AE<=100 THEN
GOTO 2600
2030 LET AE=AE*8
2040 GOTO 3000
2500 LET AE=AE*2
2510 GOTO 3000
2600 LET AE=AE*4
2510 GOTO 3000
3000 RETURN
```

Timex/Sinclair 1000 **Sinclair ZX-81**

Super-Market

Hardware

16K RAM Pack $39.95

16K Ram Packs (while they last) $39.95
Direct from England

Kayde Keyboard $74.95

Full-size Keyboard from Kayde $74.95
Includes repeat key, easily installable

Graphics ROM $59.95

Graphics ROM Hi-Resolution $59.95
The solution to the TS ZX-81. Fits inside the computer and replaces the ROM with graphics of 450 different types. The unit also has space for 4K of additional ROM or 2K of Ram.

Hi-Res Software $19.95

Hi-Resolution Software from Kayde $19.95 or $49.95 pack of three.
Peckman, Space Invaders, Centipede: Quoted the best moving graphic games on the Sinclair ZX-81.

Printer Interface $99.95

Printer Interfaces and Tape Controllers $99.95 each.
Did you know that the TS 1000 and ZX-81 can use conventional printers? Now discover the real power of the computer.
ZX-99 Tape Control of four cassette recorders and interface with any RS 232 Serial Printer. Software select to read or write plus Word-process.
ZX-98 Parallel and Serial interface board. Use one or both to enhance your computer's capability On-line to a network or to another computer or to any printer with serial or parallel interfaces.

Power Supply $19.95

Power Supply $19.95
Our very own product. "No fade and no flicker". 650 mAmps power.

Software

Inventory Control (16 to 64) $19.95
Automatically expandable to 16, 32, 48, 64K. Allows the user to specify number of lines based on Ram Pack size. Up to 250 items with a 64K.

Budget Analysis and Cash Flow Forecaster (16K) $19.95
Home or office, brand new utility. Menu driven for user ease. Manages income, fixed or variable expenses or line of credit.

Property Manager (16K) $24.95
Business or personal, provides for any combination of 10 units in two buildings or two units in five buildings. Tracks rent expenses for twelve months.

Comp-U-Share (16K) $24.95
Personal home finance. Excellent program that allows the user to keep track of his/her portfolio. Stocks, bonds, funds, etc. Detailed User Guide included.

Fantastic 1K Games

Fantastic 1K Games $9.95 or two for $17.00
Written in machine code by experts.
Challenge I- Four different tests of skill. Start out driving at Riverside and end up with a War.
Challenge II- Arcade-Style games, fast action and entertaining. You will quickly be overcome with desire to win. Three different types of games to test your reflexes.

Business Games

Business Games Feature (16K) $14.95 each.
You against the computer.
Airline- Can you do better than Sir Freddie Laker?
Restaurant- Can you serve good food and make money?
Copy Shop- Find out if you can win before you invest.
ZX/TS Dotman- This months special. Fantastic recreation of the famous arcade game. Fast moving and requires skill. Don't miss it.

PLEASE RUSH MY ORDER TO:

Name _____

Address _____

City _____ State _____ Zip _____

Charge To: VISA ☐ Master ☐

Account Number _____

Expiration Date _____

Signature _____

Send to: Data-assette (sy-5)
56 South 3rd St.
Oxford, Pa. 19363

PRODUCT NAME and CODE	UNIT PRICE	QTY.	TOTAL VALUE
Shipping/Handling			$4.95
		TOTAL ORDER	

Data-assette has over 50 software programs in its library, and we are adding more each month. If you wish to see our catalogue or join our mailing list, just send $2.50 which will apply towards your first order.

Information and product spec sheets may be obtained by mail, or phone our HOT LINE 800-523-2909; in Penna 215-932-4807.

data-assette

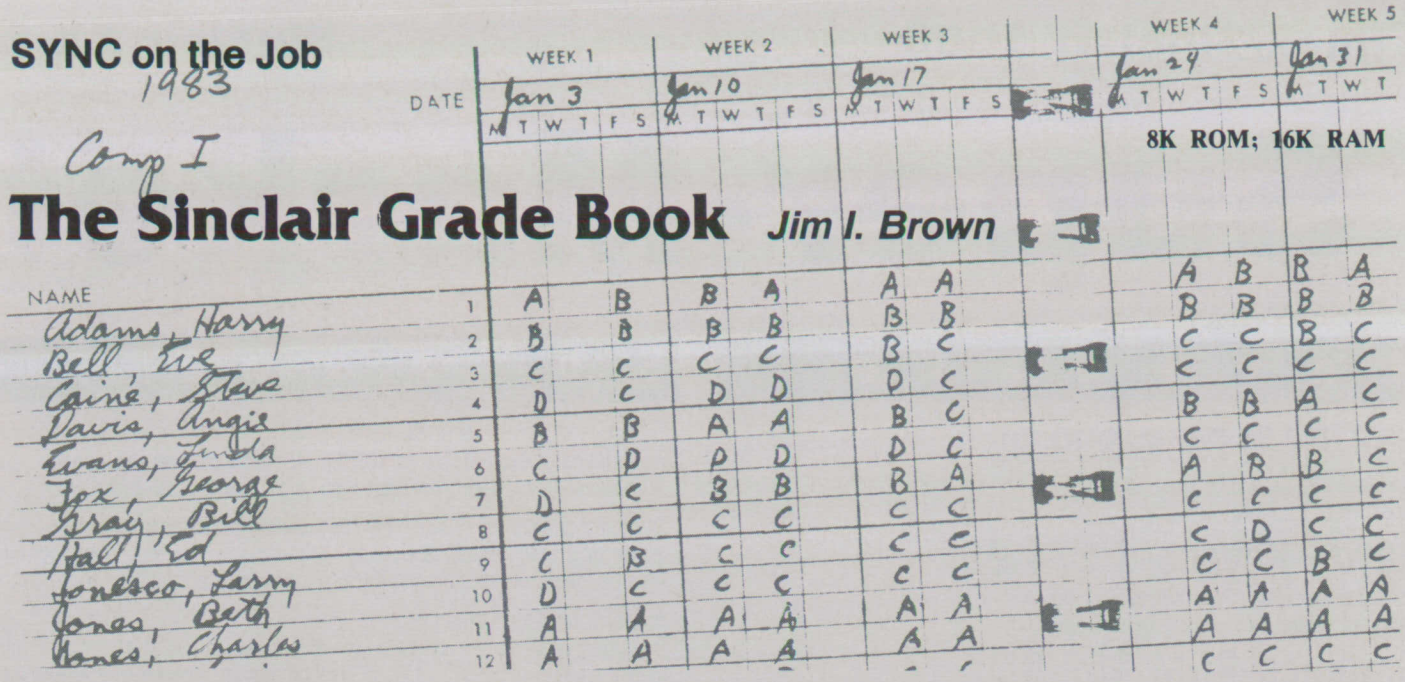
1983

Comp I

The Sinclair Grade Book

Jim I. Brown

8K ROM; 16K RAM



Two of the dullest and most time consuming routines in teaching are record keeping and grade calculation. Normally, these are done with a paper grade book in which names and scores are recorded. Whenever grades are needed, the grade book, plus a hand calculator, and a generous amount of time are usually required to provide them. Because of the time factor alone, most teachers do not figure grades except at mid-term and at the end of the semester.

The modern computer, however, can be used to change this situation by providing the teacher with an electronic grade book that can give a read out of the student's record at any time during the course by merely pushing a few keys. Thus, it becomes possible to easily and quickly supply a student with a print out of his standing after *each* exam or assignment. I know from 28 years of experience as a science teacher that the effect of this upon positive motivation can be tremendous.

In preparing a grade book program for the Sinclair, it was first necessary to decide upon the form the recorded data should be returned in. One of the advantages of a good program is that it may be returned in any number of forms, at the operator's discretion. After all, a computer does more than just keep records—it also computes (totals, percentages, etc.). In the following program, I have included provisions for the three basic types of returns which the majority of teachers will find of the greatest value.

(1) A read out of all the students in the class with each student's name accompanied by his TOTAL points, along with his percentage of the TOTAL POSSIBLE. This is mainly for the teacher's benefit in determining and submitting grades for transcripts or report cards.

(2) A print out for only one particular student, along with all of his scores, his total points, and his percentage of the possible. This may be used to provide the student with a record of his current standing for motivational reasons or to verify his score for any particular event.

(3) A sort routine for arranging the totaled grades of all students in the class from high to low. This is useful in analyzing grade distributions or in allowing a student to see where he stands in relation to the rest of the class. However, the program in this part is very slow and may take several minutes for a large class. This time could be shortened greatly by using a SHELL sort routine modified for the Sinclair. However, as I seldom use this option, I have never taken the trouble to revise it. The idea should provide an interesting challenge for *SYNC* readers.

In preparing the program, it was necessary to include a few lines which might appear confusing to the reader at first glance. One of these is the method used to keep track of the points POSSIBLE on each exam. This was easily solved by making student number one the "possible" (line 220). Thus, the first *real* student becomes N minus one in the program (line 230). Adding a new student during the course, is done by letting N become one more than the present number in class (lines 600-610). Then, since the "possible" is N equals one, and the first student is N minus one, the new student becomes N minus two (line 630). No provision was made to delete a student since a teacher is sometimes asked about a student's performance even after the student has dropped. Line 546 may also appear confusing as the .5 and the integer function had to be used to correctly ROUND OFF the percentage in line 546.

Program Structure

The general areas of the program are:

Lines 1-64: provide credits, menu, and selection of choice.

Lines 65-95: prevent accidental erasure of present roster.

Lines 102-274: establish roster of class names.

Lines 275-430: Permit entering grades for each name.

Lines 500-510: Print the names of all students.

Lines 515-543: Add grades and print total after each student's name.

Lines 545-574: Calculate and print percentage after each student's name.

Lines 600-710: Enter new students if necessary.

Lines 1500-1530: Save program and variables. It is recommended that a separate tape, along with a back-up tape be kept for each class.

Lines 1600-1645: Locate a particular student by name search.

Lines 1700-1731: Print a particular student's name, along with his scores, his total, and the percentage.

Lines 1735-1895: Allow a score to be changed, if necessary.

Lines 4000-6020: Tally and sort grades from high to low.

There are essentially only two types of variables in the program: names and scores. In line 200 N$ symbolizes the name, the number 41 represents the number of names for which space is allotted in the memory of the computer, and the number 15 is the maximum number of letters that may be used in any student's name. Remember, "possible" is N equals one, so the number 41 allows only 40

Jim I. Brown, PO Box 2221, Joplin, MO 64803.

CONVERT YOUR ZX..

FULLER MICRO SYSTEMS ADD STYLE, POWER, VERSATILITY AND FULL TYPEWRITER KEYBOARD OPERATION TO THE AMAZING ZX81 COMPUTER!

THE FULLER FD42 SYSTEM

The ideal Christmas Gift for ZX81 users.

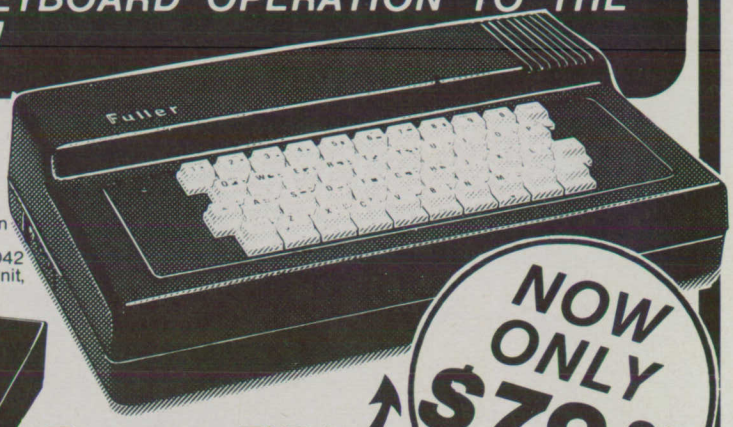
If you already are the proud owner of the fastest selling small computer in the U.S., or maybe have a friend or member of the family who's a ZX fanatic, what better buy is there this Christmas than the famous Fuller FD42 System! It converts your ZX81 into a sturdy, attractive and professional unit, with full sized typewriter keyboard. All the Sinclair ZX81 keys are duplicated with extra shift and new line keys. The professional momentary action key switches have a guaranteed life of 10^8 operations, and the whole unit comes to you complete with a money back guarantee.

IT'S EVEN CHEAPER IN KIT FORM!

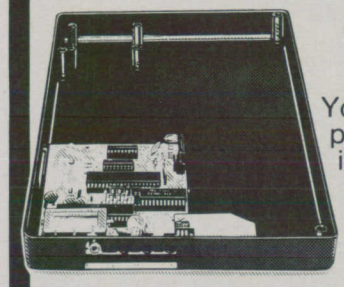
FD 42 keyboard and case kit.
$67.95 + $6 p & p.

FD 42 keyboard kit
$37.95 + $4 p & p.

Turn your ZX81 from this to this for . . .



NOW ONLY $79.95 + $6 p & p.



IT'S SO EASY TO INSTALL!

You simply unscrew the ZX printed circuit board from its base, screw it into the the new FD case, and plug in the keyboard. No soldering or technical knowledge required.

FULLER MEMORY EXPANSION

a massive boost for your ZX81!

The basic ZX81 has only 1k of RAM – now you can add on an enormous 16 or 64k with our FD Memory Modules.

FD16k _____ **$49.95** + $4 p & p.

FD16k to fit inside Fuller case _____ **$59.95** + $4 p & p.

FD64k Memory Module _____ **$129.95** + $4 p & p

ZX81 MOTHERBOARD

Also easy to install! The FD system Motherboard fits inside the Fuller case and allows expansion to the ZX memory and 1/0 facilities

_____ 2 slot **$30.95** + $4 p & p.

_____ 3 slot **$39.95** + $4 p & p.

NEW! – Programmable Sound Generator

– adds exciting new sounds to the ZX81 range **$39.95** + $4 p & p.

Separate P.S.U. 9 volts @ 2 amps **$14.95** + $4 p & p.

Plug Planner – complete with 3 metres of cable and power jack **$36.95** + $6 p & p.

Ram Adaptor Board – adapts Sinclair RAM pack to fit inside Fuller case **$19.95** + $4 p & p.

Please supply the following items:

ITEM	PRICE†	Qty.	TOTAL
Fuller FD System 42 Keyboard & case			
Fuller FD System 42 (Kit form)			
Fuller FD System Motherboard			
Fuller FD 16K. Memory Module			
Fuller 64K. Memory Module			
Sound Generator			
FD PSU 9 Volts at 2 amp.			
Fuller FD Shipping and Handling			
AD CODE			

Mail to **FULLER MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2.
England U.K.

Name .....

Address .....

City /State/Zip .....

† US Dollars

SY.3.83

Fuller MICRO SYSTEMS

Mail to: **FULL MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2.
England U.K. Telephone: 051-236 6109

Figure 1.

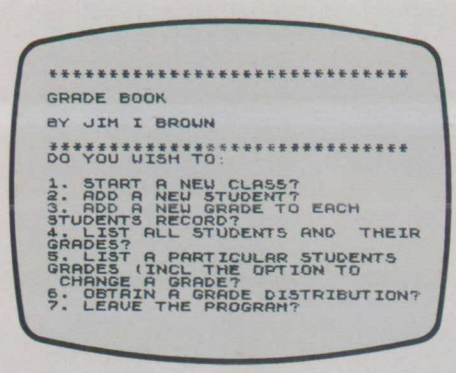

****
GRADE BOOK
BY JIM I BROWN
****
DO YOU WISH TO:
1. START A NEW CLASS?
2. ADD A NEW STUDENT?
3. ADD A NEW GRADE TO EACH STUDENTS RECORD?
4. LIST ALL STUDENTS AND THEIR GRADES?
5. LIST A PARTICULAR STUDENTS GRADES (INCL THE OPTION TO CHANGE A GRADE?
6. OBTAIN A GRADE DISTRIBUTION?
7. LEAVE THE PROGRAM?

Figure 2.

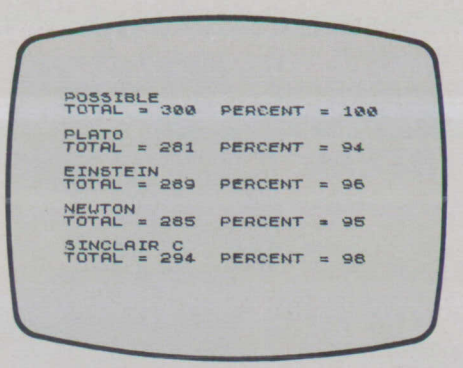
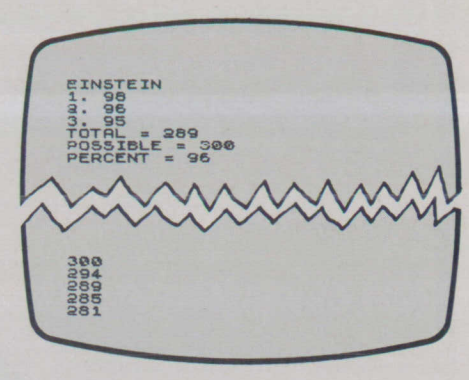


Figure 3. and Figure 4.




```
  1 FOR I=1 TO 30
  2 PRINT "*";
  3 NEXT I
  4 PRINT
  5 PRINT
 10 PRINT "GRADE BOOK"
 11 PRINT
 12 PRINT "BY JIM I BROWN"
 13 PRINT
 14 FOR I=1 TO 30
 15 PRINT "*";
 16 NEXT I
 17 PRINT
 19 PRINT "DO YOU WISH TO:"
 21 PRINT
 22 PRINT "1. START A NEW CLASS
?"
 23 PRINT "2. ADD A NEW STUDENT
?"
 24 PRINT "3. ADD A NEW GRADE T
O EACH      STUDENTS RECORD?"
 25 PRINT "4. LIST ALL STUDENTS
 AND  THEIR GRADES?"
 26 PRINT "5. LIST A PARTICULAR
 STUDENTS   GRADES (INCL THE OPT
ION TO      CHANGE A GRADE?"
 27 PRINT "6. OBTAIN A GRADE DI
STRIBUTION?"
 28 PRINT "7. LEAVE THE PROGRAM
?"
 30 PRINT
 32 PRINT "ENTER THE NUMBER OF
YOUR CHOICE."
 34 INPUT Q
 36 CLS
 50 IF Q=1 THEN GOTO 65
 52 IF Q=2 THEN GOTO 600
 54 IF Q=3 THEN GOTO 275
 56 IF Q=4 THEN GOTO 500
 58 IF Q=5 THEN GOTO 1600
 60 IF Q=6 THEN GOTO 4000
 61 IF Q=7 THEN GOTO 1500
 62 CLS
 64 GOTO 20
 65 CLS
 70 PRINT "ARE YOU SURE?"
 72 PRINT
 75 PRINT "REMEMBER A NEW ROSTE
R WILL      DELETE THE CURRENT O
NE ALONG    WITH ITS  STORED DAT
A"
 77 PRINT
 80 PRINT "ENTER ""Y"" IF YOU S
TILL WISH TO  START A NEW ROSTER
"
 81 PRINT
 82 PRINT "ENTER ""C"" TO RETUR
N TO THE MAIN MENU"
 83 INPUT R$
 84 CLS
 85 IF R$="Y" THEN GOTO 100
 95 GOTO 20
100 PRINT "HOW MANY STUDENTS AR
E IN THE    CLASS?"
102 INPUT X
103 LET X=X+1
114 CLS
115 LET U=0
200 DIM N$(41,15)
210 DIM G(41,20)
219 FOR N=1 TO X
220 LET N$(1)="POSSIBLE"
222 IF N=1 THEN GOTO 270
230 PRINT "ENTER NAME NO. ";N-1
240 INPUT N$(N)
250 CLS
260 PRINT N$(N)
270 NEXT N
271 PRINT "ENTER ""C"" TO RETUR
N TO MENU"
272 INPUT R$
273 CLS
274 GOTO 20
275 LET U=U+1
278 CLS
290 FOR N=1 TO X
295 PRINT N$(N)
296 LET V=U
298 PRINT "ENTER GRADE NUMBER "
;V
300 INPUT G(N,V)
310 CLS
320 PRINT G(N,V)
340 NEXT N
400 PRINT
410 PRINT "ENTER ""C"" TO RETUR
N TO MAIN MENU"
420 INPUT R$
425 CLS
430 GOTO 20
490 FOR N=1 TO X
500 FOR N=1 TO X
510 PRINT N$(N)
515 LET T=0
520 FOR V=1 TO U
532 LET T=G(N,V)+T
533 IF N=1 THEN LET Z=T
535 NEXT V
543 PRINT "TOTAL = ";T;"  ";
545 LET PER=(T/Z)*100
546 LET PER=INT (PER+.5)
547 PRINT "PERCENT = ";PER
548 PRINT
550 NEXT N
560 PRINT
570 PRINT "ENTER ""C"" TO RETUR
N TO THE MAIN MENU"
572 INPUT R$
573 CLS
574 GOTO 20
600 LET X=X+1
605 FOR N=1 TO X
610 NEXT N
630 PRINT "ENTER THE NAME OF ST
UDENT NUMBER ";N-2
640 INPUT N$(N-1)
650 CLS
660 PRINT "THE FOLLOWING STUDEN
T HAS BEEN  ADDED: ";N$(N-1)
670 PRINT
680 PRINT "ENTER ""C"" TO RETUR
N TO MAIN MENU"
690 INPUT R$
700 CLS
710 GOTO 20
1500 PRINT "TO SAVE THIS PROGRAM
:"
1501 PRINT
1502 PRINT "A. POSITION THE TAPE
."
1503 PRINT
1505 PRINT "B. TYPE ""C"""
1506 PRINT
1507 PRINT "C. START THE RECORDE
R"
1508 PRINT
1509 PRINT "D. PUSH NEWLINE"
1510 STOP
1520 SAVE "GRADE BOO"
1530 GOTO 1
1600 PRINT "ENTER THE NAME OF TH
E STUDENT"
1605 INPUT C$
1608 CLS
1610 LET J=LEN C$
1615 DIM M$(41,J)
1620 FOR N=1 TO X
1625 LET M$(N)=N$(N)
1630 IF C$=M$(N) THEN GOTO 1700
1635 NEXT N
1640 PRINT
1645 PRINT "NO SUCH NAME ON ROST
ER"
1650 PRINT
1655 PRINT "ENTER ""C"" TO RETUR
N TO MAIN MENU"
1660 INPUT R$
1665 CLS
1670 GOTO 20
1700 PRINT N$(N)
1705 LET T=0
1710 FOR V=1 TO U
1715 PRINT V;". ";G(N,V)
1720 LET T=G(N,V)+T
1722 IF N=1 THEN LET Z=T
1725 NEXT V
1726 PRINT "TOTAL = ";T
1727 LET PER=(T/Z)*100
1728 LET PER=INT (PER +.5)
1729 PRINT "POSSIBLE = ";Z
1731 PRINT "PERCENT = ";PER
1732 PRINT
1735 PRINT "DO YOU WISH TO CHANG
E A GRADE (Y OR N)?"
1740 INPUT R$
1745 IF R$="Y" THEN GOTO 1800
1750 CLS
1755 GOTO 20
1800 PRINT
1822 PRINT "SELECT THE NUMBER OF
 THE GRADE    TO BE CHANGED"
1825 INPUT C
1835 LET V=C
1840 CLS
1845 PRINT "ENTER THE SCORE YOU
WISH THE ";G(N,V);"     TO BE CHA
NGED TO"
1850 INPUT L
1852 CLS
1855 LET G(N,V)=L
1860 PRINT "GRADE ";V;" IS NOW "
;G(N,V)
1865 PRINT
1875 PRINT "ENTER ""C"" TO RETUR
N TO THE MAIN MENU"
1880 INPUT R$
1890 CLS
1895 GOTO 20
4000 PRINT "TOTALING GRADES"
4003 DIM M$(41)
4005 FOR N=1 TO X
4010 LET T=0
4020 FOR V=1 TO U
4030 LET T=G(N,V)+T
4040 NEXT V
4050 LET G(N,V)=T
4070 NEXT N
4075 CLS
4077 PRINT "SORTING GRADES"
4080 LET CH=0
4090 FOR N=1 TO X
5000 IF G(N,V)<G(N+1,V) THEN LET
 CH=1
5010 IF G(N,V)<=G(N+1,V) THEN LE
T MID=G(N,V)
5020 IF G(N,V)<=G(N+1,V) THEN LE
T G(N,V)=G(N+1,V)
5030 IF G(N,V)<=G(N+1,V) THEN LE
T G(N+1,V)=MID
5040 NEXT N
5050 IF CH=1 THEN GOTO 4080
5052 CLS
5060 FOR N=1 TO X
5080 PRINT G(N,V)
5090 NEXT N
6000 PRINT "ENTER C TO RETURN TO
 MENU"
6010 INPUT R$
6015 CLS
6020 GOTO 18
```

students to be entered per class. In line 210, G represents Grade, the 41 is again the number of students, while the 20 is used to reserve space in memory for 20 grades per student. These variables may, of course, be changed to allow for exceptionally sized classes or to increase the number of grades that may be taken. However, remember that increasing these values will require more memory and will also increase the LOAD/SAVE times.

Other parts of the program may also be changed to enable the computer to keep track of almost anything one wishes to maintain regular records on, while, at the same time, enabling one to obtain an instant total.

Using the Program

In using the grade book program when it is first LOADed, a menu automatically appears on the screen. (See Figure 1).

1). Selecting Choice 1 directs that a new roster be started. However, the program immediately requests the operator to first verify the choice so that any present roster will not be accidentally erased.

2). A new student may be added to the roster at any time by selecting Choice 2.

3). Choice 3 activates the computer to ask first how many points are possible on a particular test; the program then lists each student's name and requests his score for that assignment. Zero scores should be given to students who have dropped or transferred.

4). Choice 4 causes the computer to print out the total points for each student, along with his percentage of the POSSIBLE (See Figure 2).

Note: since the program directs the computer to first ADD the student's scores, this choice may cause the program to bomb if there is only one grade entered for the class.

5). Choice 5 instructs the computer to request a student's name, then to list that particular student's scores along with his total points and his percentage rating. (See Figure 3).

Before returning to the main menu, the program also inquires if any grade is to be corrected and allows the operator to make the necessary change if one is needed. New students who were added under Choice 2 will have zeros automatically recorded for any grades that were entered before they joined the class. Choice 5 allows the instructor to change these zeros to whatever transfer grades students may have entered with.

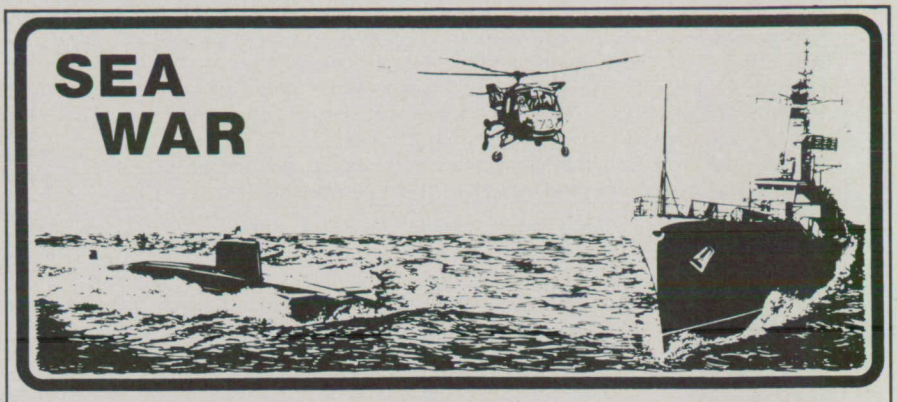
6). Choice 6 first tallies the grades of every student; then it sorts and displays the scores, arranging them from highest to lowest. (See Figure 4.)

7). Choice 7 allows the program, including all changes or additions in grades or names, to be saved and provides the directions for accomplishing this.

If, during any choice, the print out should fill the monitor and give a report code of 5 at the bottom (meaning no more room on screen), merely push "CONTinue" on the keyboard, followed by NEWLINE.

If for any reason the program should "bomb" at any point, it can usually be safely restarted by the command, GOTO 1, followed by NEWLINE. Never use "RUN" as a command, or all the stored data (names and scores) will be lost.

Ed.—For the convenience of our readers the author will supply tthe program on cassette for $12 including postage ($15 outside the U.S.). Allow four weeks if payment is made by personal check. ■



SEA WAR
FOR ZX81

This game is designed for one or two players. Each player has three submarines. As a certain number of points are reached, bonus submarines will be given. When the game is going on, the higher the score you get, the more that hostile features will appear on the screen.

The features which appear on the screen are as follows:
Submarine, Warship, U-boat and Helicopter.

Submarine
This feature is under your own control and is loaded at the left hand side of the screen. The keys '9' and '0' are the firing buttons for the upward missiles and forward missiles respectively.

The submarine can be moved in four directions; it can move upwards and downwards by pressing keys '7' and '6' respectively. In order to move forward, you press key '8' and it will draw back to its previous position when you release the button. Also, the submarine can be moved diagonally upwards or downwards by pressing both keys '8' and '7' or keys '8' and '6' respectively at the same time.

U-boat
This is the hostile submarine: It drifts under the sea level randomly, from right to left. Missiles are fired as it approaches your submarine. Destroying a U-boat scores 20 points.

Warship
This is the enemy destroyer which will release bombs diagonally as it drifts on the sea surface from right to left.

The destruction of a warship is done by either firing a vertical missile or, when the submarine is just under sea level, by pressing keys '7' and '0' which release a horizontal missile. Otherwise the missiles will just pass under the ship bottom. Each destruction of this feature scores 50 points.

Helicopter
As you reach a certain score, helicopters appear on the left hand corner of the screen; they drop vertical bombs as they hover above the submarine. To destroy the helicopters, vertical missiles can be fired by pressing key '9'. Each helicopter destroyed scores 100 points.

*New Game—ADDER—Arcade-type game.
Shoot the numbers as they pass across the screen, but watch your total.

Each game $9.95 plus $2.00 postage/handling
Distributor Inquiries Welcome

Panda Software,
51 Elgin Street, Shelton
Stoke-on-Trent ST4 2RD, England

dk'tronics

ZX KEYBOARD FOR USE WITH 80/81 SPECTRUM

Our new cased keyboard has 52 keys, 12 of these are used for the numeric pad. The numeric pad offers some useful features, you can cursor with one hand and it will be a boon for anyone who enters a lot of numeric data. The pad is a repeat of the 1-9 keys plus it has a full stop and a shift key. The numeric pad keys are coloured in red, the normal keyboard keys are grey, with the case being black which makes the whole thing very attractive. The case measures 15 × 9 × 2½. The computer (either 80/81 or spectrum) fits neatly inside. You will have to remove the computer from its original case, it is then screwed to the base of the case. The case had all the bosses already fitted and the screw holes are marked. Also fitted inside the case is a mother board (81 model only) which allows 16K, 32K and 64K to be fitted in the case. All the connections are at the rear of the case i.e. Power, Mic, Ear, T.V. and the expansion port. The case is large enough for other add ons also to be fitted inside. One of these could be the power supply, then you could very quickly fit a mains switch, or a switch on the 9V line. This means you have a very smart self-contained unit. This case does not stop you from using any other add-ons that you may have e.g. Printer etc. We are convinced that this is the best keyboard available at present. It offers more keys and features than any other keyboard in its price range.

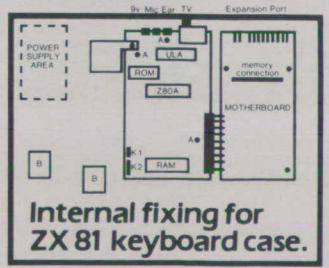
NOTE

The case can be purchased separately with the keyboard aperture uncut, so if you have one of our early uncased keyboards, or in fact any other suppliers' keyboards, these could be fitted. The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute job and requires no electronic skills. This keyboard does not need any soldering. Please specify on order whether you require the ZX 81 or Spectrum case.

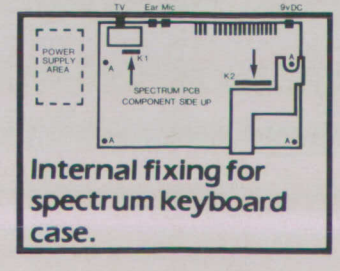
SPECTRUM MODEL

This is supplied with spectrum legends, and a slightly different base for fitting the spectrum inside, again all the connectors are at the rear of the case and there is plenty of room for the power supply (and other add-ons). Should you want to change, we can supply both the Spectrum legends and details of updating your case which will enable modification from the ZX 81 to spectrum. PLEASE specify on your order whether you require the ZX 81 or spectrum case.

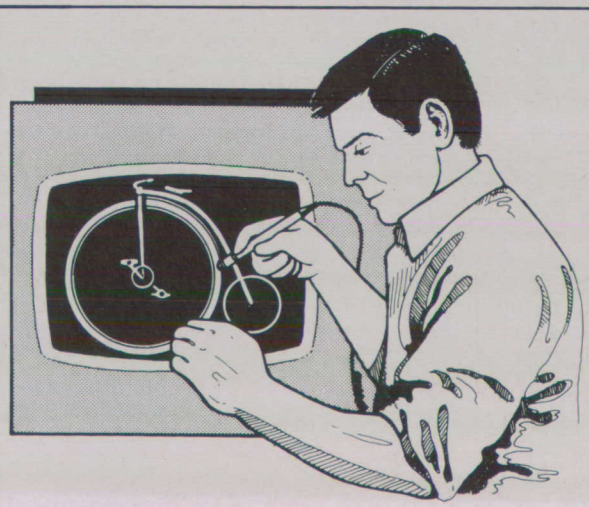
KEYBOARD (SPECTRUM/81) **$72**



Internal fixing for ZX 81 keyboard case.



Internal fixing for spectrum keyboard case.



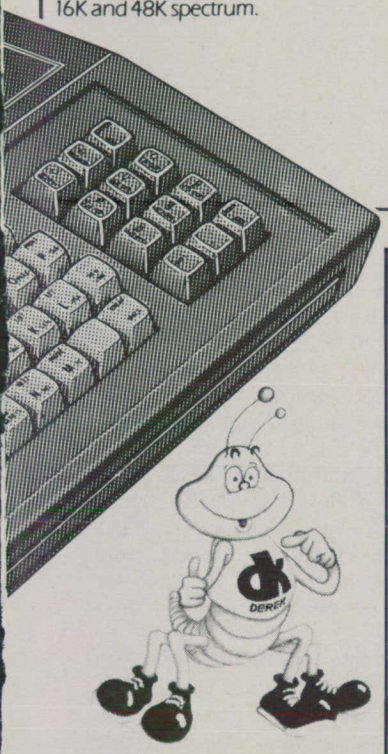
SPECTRUM LIGHT PEN

The pen enables you to produce high resolution drawings on your own television set, saving a vast amount of time over using basic programming statements, such as Plot, Draw etc. You can erase, modify and save drawings and it comes complete with software program. The superb light pen is available from DK Tronics at only **$31.95**

ZX 80~81 Spectrum HARDWARE

4K TOOLKIT

This is the toolkit which won acclaim in the feature in the August 1982 issue (pages 29 and 30) of Sinclair User. "It is the most impressive program, fast in execution with clear and full instructions...it stands out from the rest of the field." The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER AND VERIFY. The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K spectrum.



Both at only $10.55

4K GRAPHICS ROM $39.95

The DK Graphic module is our latest ZX 81 accessory. This module unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you an unbelievable 448 extra pre-programmed graphics, your normal graphic set contains only 64. This means that you now have 512 graphics and with their inverse 1024. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

WHY WAIT?
ORDER TODAY FOR FAST DELIVERY

FLEXIBLE RIBBON CONNECTOR

If you have ever had whiteouts or system crashes this could be the answer. It stops the movement between the computer and the RAM expansion, it is supplied with a ribbon, 6 inches long, with a male connector at one end and a female at the other, at only

$16

16/64 MEMORY FOR ZX 81 T/$1000

16K Memory £22.95
16K (uncased) £19.95
64K Memory £52.95
64K (uncased) £49.95

The above illustration shows the casing for the 16K or massive 64K.

MEMORY, T/$1000

16K MEMORY EXPANSION **$36.75**

The 16K used 4116 Dynamic Ram Chips. We use the dynamic because they are much denser than static ram and occupy less space. They are also much cheaper than the equivalent product using the static Ram. The Ram is manufactured with high quality materials and uses high speed low power Rams. It is supplied ready-built and only needs to be plugged into the rear of the computer. All the components are fitted into holders. This massive add on memory which comes to you fully assembled and tested is the cheapest 16K memory available anywhere. Position in memory from 163834 to 32768 (same as the Sinclair Memory). **16K (UNCASED) $31.95**

64K MEMORY EXPANSION **$84.75**

All the above information on the 16K also applies to the 64K Memory Expansion, but the advantage lies in the 64K giving nearly four times the memory. This advanced model has 56K of usable memory. In addition, the block from 8K to 16K can be switched out to enable the use of other add-ons. The graphics Rom is to be used in this area. Position in Memory: 8192-65536. The block from 81¾2-16384 is switchable. **64K (UNCASED) $79.95**

Please state type of machine, which Rom memory size, quantity and place when ordering.

Please send me . . . . . @ $ . . . . .

Please send me . . . . . @ $ . . . . .

Please send me . . . . . @ $ . . . . .

Please add on **$2.00** for P/P

In enclose cheque/P.O. payable to DK Tronics total $ . . . . .

or debit my Access/Barclaycard [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Signature . . . . . BARCLAYCARD VISA

Name . . . . . .

Address . . . . . .

. . . . . .

Send to DK Tronics, 23 Sussex Road, Gorleston, Gt. Yarmouth, Norfolk.
Tel: Gt. Yarmouth (0493) 602453 England

dk'tronics

New colour brochure now available, send SAE for quick return

8K ROM; 16K RAM

Knowing Your Strengths

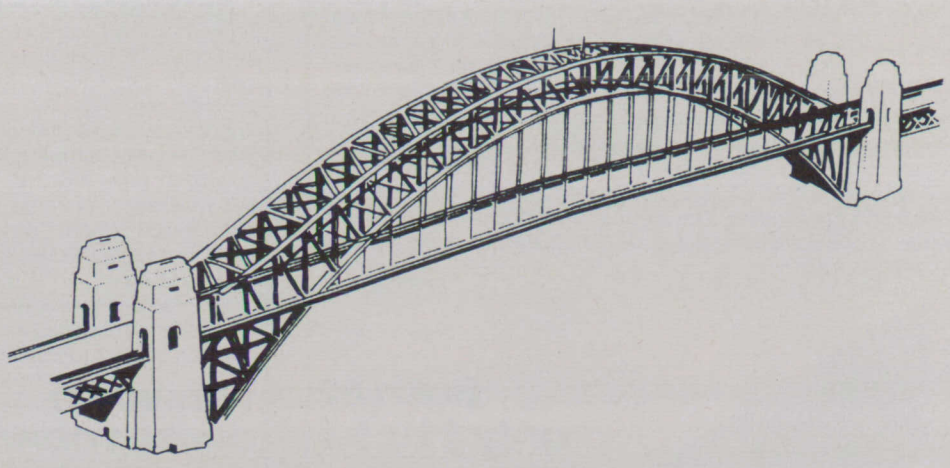
Philip Crossman

As an Industrial Designer, I am often required to specify the minimum practical amounts of material and the most effective configurations that will safely support a given load before spending thousands of dollars in tooling to produce parts for testing. Unfortunately, my staff does not include a graduate stress analyst, and my budget does not permit the use of high-priced consultants.

So I have been accustomed to resorting to a very handy and reliable reference work, *Machinery's Handbook*, which has collected all the standard formulas in the field necessary to perform a simple stress analysis. Even though I programmed my Commodore PR100 hand-held calculator to help, the repeated calculations of various sections and materials under various loading conditions would still take many hours of tedious labor.

As soon as I became moderately confident with my ZX80 and its extended ROM/RAM, I resolved to commit this process to the computer. The program I developed for this task is listed below. The results have proved extremely rewarding. Now I can try out literally hundreds of possibilities in a matter of minutes, and I have found the results to be surprisingly reliable and predictive of actual performance.

In order to minimize LOADing time (nearly 5 minutes), I only programmed those sections, materials, and characteristics that we commonly encounter in our line of work. Needless to say, the program can be easily modified to accommodate the formulas that apply to your particular situation from your own sources.



Program Structure

The program should prove quite user-friendly and essentially self-instructive. Its basic structure rests on the following routine:

1) Select a section (or shape) and enter the dimensions.

2) Select a material (to get Modulus of Elasticity and Tensile Strength).

3) Select a "loading model" and enter load and length.

You can change any segment of the data by returning to the appropriate section and recalculate the results without reentering unchanged data. To alter any single variable, without affecting others, simply enter the data with a "LET" statement. To deal with more complex sections (or shapes), refer to any of the standard reference works (e.g., *Machinery's Handbook*) for methods used to "mass" such shapes into simpler forms which can be handled by the program.

The Modulus of Elasticity and Tensile Strengths for most materials can be found in works such as *Machinery's Handbook* and *The Plastics Directory*, and I am indebted to both of them. The wood data are interpolated from various sources and may be somewhat unreliable. You can alter these sections to suit your needs, but I recommend using actual test data wherever possible or manufacturer's literature when available.

Using the Program

Suppose, for example, that you want to know the size and thickness of aluminum tube needed to mount a series of theater seats from supports a given distance apart. The tube will be firmly clamped in rigid cast iron supports (it makes a difference).

1) After you have typed in the program and SAVEd it (or if you are working from a tape, LOAD "STRENGTH"), hit RUN and ENTER.

2) You will be presented with a "SHAPE TABLE." Select and enter an appropriate shape; in this case, enter 2 for a square tube. This calls up a graphic with various dimensions outlined.

3) The program will ask for "T" or thickness (if you know it). Let's assume we do not know T, so enter 0.

4) It will ask for "D" the height dimension. Let's try a 2 inch square tube. Enter 2 for both D and B.

5) Because we did not know the thickness, it will ask for the inside dimensions: "H" corresponding to D and "K" corresponding to B. Enter 1.75 for both of these. The computer goes blank for a second or so while it calculates. Then it displays: T (thickness), Section Area, Section Modulus, Moment of Inertia, and Radius of Gyration (this is included for use in the Torsional calculations later on).

6) The last line will ask for the next step. Since this is an initial calculation, with no previous data resident, we must enter 2 for material data. This calls up a "MATERIALS TABLE", listing 10 common materials. Let's choose an extruded tube of 6063-T5 aluminum. Enter 6. The Tensile Strength and Modulus of Elasticity (abbreviated MOD.EL.) are displayed: T, 29000; M.E., 10.3 million.

7) The last line will ask you to press ENTER to continue. This calls up a "BEAM LOAD TABLE" with 6 common loading diagrams. Since our beam will be firmly fixed in its supports, select 6. This recalls the appropriate loading diagram and asks for the load in pounds (W). Let's suppose that 3 chairs are mounted between supports, the supports are 72 inches apart, and the chairs must accomodate occupants weighing up to 300 pounds each plus 20 pounds for each chair for a total of 960 pounds. Enter 960 for W and

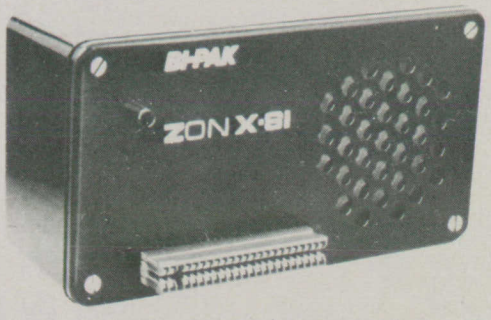
Philip Crossman, 7381 Grachen, SE, Grand Rapids, MI 49508.

SOUND with ZX-81!

SOUND with ZX-81!

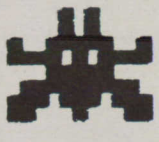
MAKE AMAZING SOUND EFFECTS WITH YOUR ZX-81

Timex Sinclair 1000



$49.95
Incl. airmail postage

THE ZON X-81



- The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in—no dismantling or soldering.
- No power pack, batteries, leads or other extras.
- Manual Volume Control on panel—ample volume from built-in loudspeaker.
- Standard ZX-81—16K Rampack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
- Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords, etc., or whatever you devise!
- 8 full octaves. Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
- Easily added to existing games or programmes using a few simple "BASIC" lines or machine code.
- No memory addresses used—I.O. mapped.

FULL Instructions with many examples of how to obtain effects and the programmes, supplied. Fully Guaranteed.

Payment may be made by Bank Cheque or International Money Order in U.S. $ or £ Sterling Payable to:

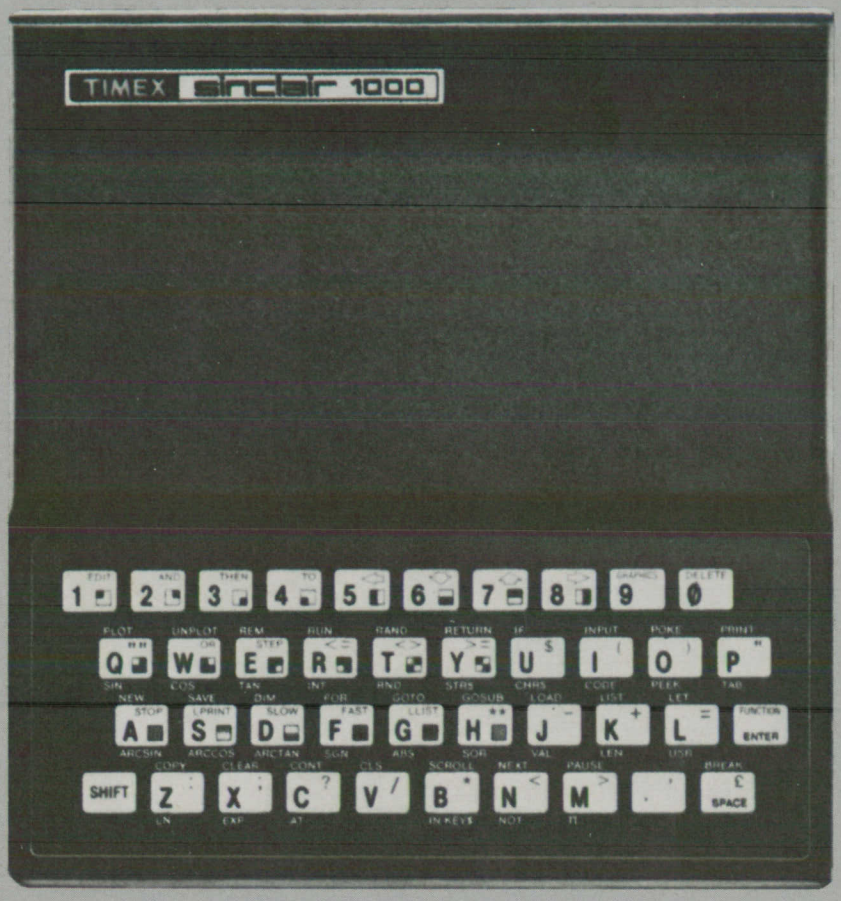
BI-PAK

P.O. Box 6
Ware, Herts
England
Phone #0920-3182

Visa-Mastercard accepted
Send account #
with name & address

```
  5 REM "STRENGTH"
  7 PRINT "      STRENGTH OF MAT
ERIALS      "
  8 PRINT "
  10 PRINT "      SHAPE TABL
E      "
  11 PRINT
  12 PRINT
  13 PRINT " 1   SQ/RECT SOLID"
  14 PRINT " 2   SQ/RECT TUBE"
  16 PRINT " 3   ROUND SOLID"
  18 PRINT " 4   ROUND TUBE"
  20 PRINT " 5   I SECTION"
  22 PRINT " 6   H SECTION"
  24 PRINT " 7   C SECTION"
  26 PRINT " 8   L SECTION"
  28 PRINT " 9   U SECTION (INVER
TED)"
  30 PRINT "10   T SECTION"
  32 PRINT "11   + SECTION"
  40 PRINT
  45 PRINT
  50 PRINT "ENTER APPROPRIATE SH
APE CODE"
  55 INPUT S1
  65 CLS
  66 IF S1>11 THEN LET S=19
  70 GOTO S1*100
 100 PRINT "      SQUARE/RECTANGUL
AR SOLID      "
 104 PRINT
 105 PRINT "          DIRECTION"
 106 PRINT "           OF LOAD"
 110 PRINT "
 112 PRINT "      D
 114 PRINT "
 116 PRINT "
 118 PRINT "
 120 PRINT "
 122 PRINT "
 124 PRINT
 128 PRINT "B=";
 130 INPUT B
 132 PRINT B;"   ";
 136 PRINT "D=";
 138 INPUT D
 140 PRINT D;"   ";
 142 LET Y=D/2
 146 PRINT "Y=";Y
 148 PRINT
 149 LET T=0
 150 LET A=B*D
 152 LET I=(B*(D**3))/12
 154 LET Z=(B*(D**2))/6
 155 LET K=SQR (I/A)
 156 GOSUB 1600
 166 PRINT
 168 GOTO 1500
 200 PRINT "      SQUARE/RECTANGU
LAR TUBE      "
 202 PRINT "
 204 PRINT "                D=OUTSI
DE DEPTH"
 206 PRINT "                B=OUTSI
DE BREADTH"
 208 PRINT "                H=INSID
E DEPTH"
 210 PRINT "      H  K=INSID
E BREADTH"
 212 PRINT "                T=THICK
NESS (WALL)"
 214 PRINT "      Y:  Y=MOMEN
T"
 216 PRINT "
 218 PRINT "
 220 PRINT "
 222 PRINT "                ENTER
T (IF KNOWN)"
 224 PRINT "          ""0""
IF UNKNOWN"
 228 PRINT
 230 INPUT T
 236 PRINT "D=";
 238 INPUT D
 240 PRINT D;"   B=";
 244 INPUT B
 246 PRINT B;
 248 IF T<>0 THEN GOTO 262
 249 PRINT "   H=";
 250 INPUT H
 252 PRINT H;"   K=";
 254 INPUT K
 256 LET T=(B-K)/2
 258 PRINT K;"   T=";T
 260 GOTO 270
 262 LET H=D-2*T
 264 LET K=B-2*T
 266 PRINT "   H=";H;"   K=";K;"
T=";T
 268 LET Y=D/2
 270 LET A=(D*B)-(H*K)
 272 LET Z=((B*D**3)-(H*K**3))/6
*D
 274 LET I=((B*D**3)-(H*K**3))/1
2
 275 LET K=SQR (I/A)
 276 GOSUB 1600
 278 PRINT
 280 GOTO 1500
 282 STOP
 300 PRINT "      ROUND SOLI
D      "
 302 PRINT "
 304 PRINT "
 306 PRINT "
 308 PRINT "
 310 PRINT "      *D   D=DIAM
ETER"
 312 PRINT "
 314 PRINT "      Y   Y=DIST
NEUT.TO EXT"
 316 PRINT "
 318 PRINT "
 320 PRINT
 322 PRINT "D=";
 324 INPUT D
 326 LET Y=D/2
 328 PRINT D;"   Y=";Y
 329 LET B=D
 330 LET A=.7854*(D**2)
 331 LET T=0
 332 LET Z=.098*(D**3)
 334 LET I=.049*(D**4)
 335 LET K=SQR (I/A)
 336 GOSUB 1600
 338 PRINT
 340 GOTO 1500
 350 STOP
 400 PRINT "      ROUND TUB
E      "
 402 PRINT "
 404 PRINT "
 406 PRINT "
 408 PRINT "
 410 PRINT "
 412 PRINT "
 414 PRINT "
 416 PRINT "
 418 PRINT "
 420 PRINT TAB 11;":"
 422 PRINT TAB 11;"T"
 424 PRINT "ENTER T (IF KNOWN),
0 (IF NOT)"
 426 INPUT T
 432 PRINT "OD=";
 434 INPUT OD
 436 IF T<>0 THEN GOTO 446
 438 PRINT OD;"   ID=";
 440 INPUT ID
 442 PRINT ID;"   T=";(OD-ID)/2;"
 Y=";OD/2
 444 GOTO 451
 446 LET ID=OD-(2*T)
 448 LET Y=OD/2
 450 PRINT OD;"   ID=";ID;"   T=";
T;"   Y=";Y
 451 LET B=ID
 452 LET A=.7854*(OD**2-ID**2)
 453 LET D=OD
 454 LET I=.049*(OD**4-ID**4)
 456 LET Z=.098*((OD**4-ID**4)/O
D)
 457 LET K=SQR (I/A)
 458 GOSUB 1600
 460 PRINT
 462 GOTO 1500
 464 STOP
 500 PRINT "      I-SECTION
      "
 501 LET N=5
 502 PRINT "
 504 PRINT "
 506 PRINT "
 508 PRINT "
 510 PRINT "
 512 PRINT "
 514 PRINT "
 516 PRINT "
 518 PRINT "
 520 PRINT "
 522 PRINT "
 524 PRINT "
 526 PRINT "
 530 PRINT "T=";
 532 INPUT T
 534 PRINT T;"   F=";
 536 INPUT F
 538 PRINT F;"   D=";
 540 INPUT D
 542 LET H=D-(2*F)
 543 LET Y=D/2
 544 PRINT D;"Y=";Y;"   H=";H;"
B=";
 546 INPUT B
 548 PRINT B
 550 IF N<>5 THEN GOTO 30+(N*100
)
 552 LET Y=D/2
 554 LET A=(B*D)-(H*(B-T))
 556 LET I=((B*(D**3))-((H**3)*(
B-T)))/12
 558 LET Z=I/Y
 559 LET K1=(B*D**3)-(H**3*(B-T)
)
 560 LET K2=12*((B*D)-(H*(B-T)))
 561 LET K=SQR (K1/K2)
 564 PRINT "AREA=";A;"   S.MOD=";
Z;"MOMIN=";I;"   RAGY=";K
 566 GOTO 1500
 600 PRINT "      H-SECTION
      "
 601 LET N=6
 602 PRINT
 604 PRINT "
 606 PRINT "
 608 PRINT "
 610 PRINT "
 612 PRINT "
 614 PRINT "
 616 PRINT "
 618 PRINT "
 620 PRINT "
 622 PRINT "
 624 PRINT "
 628 GOTO 528
 630 LET Y=B/2
 632 LET A=(B*D)-(H*(B-T))
 634 LET I=((2*F*(B**3))+(H*(T**
3))/12
 636 LET Z=I/Y
 637 LET K1=2*F*(B**3)+H*(T**3)
 638 LET K2=12*((B*D)-(H*(B-T)))
 639 LET K=SQR (K1/K2)
 640 GOTO 564
 700 PRINT "      C-SECTION
      "
 701 LET N=7
 702 PRINT "
 704 PRINT "
 706 PRINT "
 708 PRINT "
 710 PRINT "
 712 PRINT "
 714 PRINT "
 716 PRINT "
 720 PRINT "
 722 PRINT "
 724 PRINT "
 726 PRINT "
 727 PRINT "
 728 GOTO 528
 730 LET Y=D/2
 732 LET A=(B*D)-(H*(B-T))
 734 LET I=((B*(D**3))-((H**3)*(
B-T)))/12
 736 LET Z=I/Y
 737 LET K1=(B*D**3)-(H**3*(B-T)
)
 738 LET K2=12*((B*D)-(H*(B-T)))
 739 LET K=SQR (K1/K2)
 740 GOTO 564
 800 PRINT "      L-SECTION
      "
 801 LET N=8
 802 PRINT "
 804 PRINT "
 806 PRINT "
 808 PRINT "
 810 PRINT "
 812 PRINT "
 814 PRINT "
 816 PRINT "
 818 PRINT "
 820 PRINT "
 822 PRINT "
 824 PRINT "
 826 PRINT "
 828 PRINT "
 830 PRINT "
 834 PRINT "T=";
 836 INPUT T
 838 PRINT T;"   B=";
 840 INPUT B
 841 PRINT B;"   L=";
 842 INPUT L
 845 LET D=B-T
 846 LET Y=B-(T*(2*D+L)+(D**2))/
(2*(D+L))
 848 PRINT L;"   D=";D;"   Y=";Y
 850 LET A=T*(L+D)
 851 LET E=(T*(Y**3))+L*((B-Y)**
3)
 852 LET P=(L-T)*((B-Y-T)**3)
 853 LET I=(E-P)/3
 854 LET Z=I/Y
 856 LET K=SQR ((I/(3*T*(L+B-T))
)*(T*(Y**3)+L*((B-Y)**3)-((L-T)*
((B-Y-T)**3))))
 858 GOTO 564
 900 PRINT "      INVERTED V-SE
CTION      "
 901 LET N=9
 902 PRINT "
 904 PRINT "
 906 PRINT "
 908 PRINT "
 910 PRINT "
 912 PRINT "
 914 PRINT "
 916 PRINT "
 918 PRINT "
 920 PRINT "
 922 PRINT TAB 12;"T=";
 924 INPUT T
 926 PRINT T;"   L=";
 927 INPUT L
 928 PRINT L
 929 LET B=L
 930 LET A=T*((2*L)-T)
 931 LET D=L
 932 LET Y=((L**2)+(L*T)-(T**2))
/(2*(2*L-T)*COS (45))
 934 LET P=Y*COS (45)
 936 LET I=(2*(P**4)-(2*(P-T)**4
)+T*(L-(2*P-T/2))**3)/2
 938 LET Z=I/Y
 940 LET K=SQR (I/A)
 942 PRINT "Y=";Y;"  AREA=";A;"  S
.MOD=";Z
 944 PRINT "MOMIN=";I;"  RAGYR=";
K
 946 PRINT
 948 GOTO 1500
 950 PRINT
1000 PRINT "      T-SECTION
      "
1002 PRINT "
1004 PRINT "
1006 PRINT "
1008 PRINT "
1010 PRINT "
1012 PRINT "
UTRAL FIBER"
1014 PRINT "
1016 PRINT "
1018 PRINT "
1020 PRINT "
TREME FIBER"
1022 PRINT "
1023 PRINT "
1024 PRINT "
1025 PRINT "T=";
1026 INPUT T
1028 PRINT T;"   F=";
1030 INPUT F
1032 PRINT F;"   B=";
1034 INPUT B
1036 PRINT B;"   D=";
1038 INPUT D
1040 PRINT D
1041 LET H=D-F
1042 LET A=B*F+H*T
1044 LET Y=D-(((D**2)*T+(F**2)*(
B-T))/(2*A))
1045 PRINT "H=";H;"   Y=";Y
1046 LET I=.5*(T*Y**3)+B*(D-Y)**
3-(B-T)*(D-Y-F)**3
1048 LET Z=I/Y
1050 LET K=SQR (I/A)
1052 GOTO 564
1100 PRINT "      + SECTION
      "
1101 LET N=11
1102 PRINT "
1104 PRINT "
```

LOVE AT FIRST BYTE



C-20 Magazine has something for every TS-1000 or ZX-81 owner to love each month. We offer 2K and 16K programs in each issue.

Educational Software
Software for your Home
Games Games Games
Editorial Section
The C-20 Mailbox
Classified Ads

A Big Time-Saving Value. Less than $4.99 per issue with over 75 programs per year. That's less than 75 cents per program!

C-20 *Magazine*

Big Savings if you order Now!

1 Year (12 issues) $59.95
Bonus 13th issue free
Bonus ends March 14th
6 Months (6 issues) $38.95

Kansas residents add 3%. First class mail included in North America. All others add $10 per subscription.

24 Hr. Toll Free Order Line
1-800-835-2246 Ext. 240
or in Kansas
1-800-362-2421 Ext. 240

P.O. Box 3801
Wichita, Ks. 67201-3801

515 N. Ridge Road / Suite B
Wichita, Ks. 67212

```
1106 PRINT "
1108 PRINT "
1110 PRINT "
1112 PRINT "-+-
1114 PRINT "
1116 PRINT "-+-
1118 PRINT "
1120 PRINT "  F
1122 PRINT "
1124 PRINT "
1126 PRINT "
1128 PRINT "
1130 PRINT "T=";
1132 INPUT T
1134 PRINT T;" F=";
1135 INPUT F
1136 PRINT F;" D=";
1137 INPUT D
1138 PRINT D;" B=";
1140 INPUT B
1142 LET A=D*T+F*(B-T)
1144 LET Y=D/2
1146 LET I=((T*D**3)+(F**3)*(B-T
))/12
1145 LET Z=I/Y
1150 LET K=SQR (I/A)
1152 PRINT B;" Y=";Y
1154 GOTO 564
1200 PRINT "[REVERSE] MATERIALS TA
BLE [REVERSE]"
1205 PRINT
1210 PRINT "1   CLASS 25 CAST GRA
Y IRON"
1215 PRINT "2   DUCTILE (NODULAR)
CAST IRON"
1220 PRINT "3   1025 LOW CARBON S
TEEL"
1225 PRINT "4   30302 STAINLESS S
TEEL"
1230 PRINT "5   51430 STAINLESS S
TEEL"
1235 PRINT "6   6063 T5 ALUMINUM"
1240 PRINT "7   6061 T6 ALUMINUM"
1245 PRINT "8   NO.2 STRUCTURAL D
OUGLAS FIR"
1250 PRINT "9   INJ. MOLDED ABS O
R HIS"
1255 PRINT "10 MOLDED NYLON 6+40
 PCT. GLASS"
1260 PRINT
1265 PRINT "ENTER APPROPRIATE MA
TERIAL CODE"
1270 INPUT G
1275 PRINT
1280 PRINT
1300 IF G=1 THEN LET E=14.2
1305 IF G=1 THEN LET S=25000
1310 IF G=2 THEN LET E=25
1315 IF G=2 THEN LET S=80000
1320 IF G=3 THEN LET E=30
1325 IF G=3 THEN LET S=80000
1330 IF G=4 THEN LET E=28
1335 IF G=4 THEN LET S=105000
1340 IF G=5 THEN LET E=29
1345 IF G=5 THEN LET S=80000
1355 IF G=6 THEN LET E=10.3
1360 IF G=6 THEN LET S=29000
1365 IF G=7 THEN LET E=11.4
1370 IF G=7 THEN LET S=48000
1375 IF G=8 THEN LET E=1.3
1380 IF G=8 THEN LET S=1300
1385 IF G=9 THEN LET E=.29
1390 IF G=9 THEN LET S=5500
1395 IF G=10 THEN LET E=1.5
1400 IF G=10 THEN LET S=26000
1405 PRINT
1410 LET E=E*10**6
1415 PRINT "TENSILE=";S;" MOD.EL
.=";E
1420 PRINT
1425 PRINT "PRESS ""ENTER"" TO C
ONTINUE"
1430 INPUT A$
1435 CLS
1440 GOTO 2000
1500 PRINT "ENT:(1)SEC(2)MAT(3)L
OAD(4)RECALC"
1510 INPUT N
1515 CLS
1520 IF N=1 THEN GOTO 10
1530 IF N=2 THEN GOTO 1200
1540 IF N=3 THEN GOTO 2000
1545 IF N=4 THEN GOTO 3500
1550 STOP
1600 PRINT "SECTION AREA =";A
1610 PRINT "SECTION MODULUS =";Z
1620 PRINT "MOMENT OF INERTIA ="
;I
1622 PRINT "RAD. OF GYRATION=";K
1630 RETURN
1900 PRINT "SHAPE NOT YET PROGRA
MMED","PRESS ""ENTER"" TO RETURN
 SHAPE TABLE"
1910 INPUT A$
1915 CLS
1920 GOTO 10
1930 STOP
2000 PRINT "[REVERSE] BEAM LOAD TA
BLE [REVERSE]"
2001 LET X=0
2002 PRINT
2004 PRINT "WWWWWWWWW"
2006 PRINT "[REVERSE] 1 SUPPORTE
D BOTH ENDS"
2008 PRINT "[REVERSE]  [REVERSE]  UNIFORM
LOAD"
2009 GOSUB 2070
2010 PRINT TAB 4;"W"
2012 PRINT "[REVERSE] 2 SUPPORTE
D BOTH ENDS"
2014 PRINT "[REVERSE]  [REVERSE]  CENTRAL
LOAD"
2015 GOSUB 2070
2016 PRINT TAB 2;"W"
2018 PRINT "[REVERSE] 3 SUPPORTE
D BOTH ENDS"
2020 PRINT "[REVERSE]  [REVERSE]  LOAD OFF
-CENTER"
2021 PRINT
2022 GOSUB 2070
2023 PRINT "[REVERSE]WWWWWWW 4 FIXED ON
E END"
2024 PRINT "[REVERSE]  UNIFORM
LOAD"
2026 PRINT "[REVERSE]"
2027 GOSUB 2070
2028 PRINT "[REVERSE]  W 5 FIXED ON
E END"
2030 PRINT "[REVERSE]  LOADED O
THER"
2032 PRINT "[REVERSE]"
2033 GOSUB 2070
2034 PRINT "[REVERSE]WWWWW[REVERSE] 6 FIXED BO
TH ENDS"
2036 PRINT "[REVERSE]  [REVERSE]  UNIFORM
LOAD"
2038 PRINT "[REVERSE]  [REVERSE]"
2039 GOSUB 2070
2040 PRINT TAB 3;"**ENTER APPROP
RIATE CODE**"
2045 INPUT X
2050 CLS
2055 GOTO 2000+(X*100)
2060 STOP
2070 IF X>0 THEN GOTO 2020+(X*10
0)
2075 RETURN
2080 STOP
2100 LET X=1
2110 GOTO 2004
2120 PRINT
2130 GOSUB 3000
2140 LET S2=-(W*L)/(8*Z)
2150 LET U=(5*(W*(L**3)))/(384*E
*I)
2160 GOTO 3500
2170 STOP
2200 LET X=2
2210 GOTO 2010
2220 PRINT
2230 GOSUB 3000
2240 LET S2=(W*L)/(4*Z)
2250 LET U=(W*(L**3))/(48*E*I)
2260 GOTO 3500
2270 STOP
2300 LET X=3
2310 GOTO 2016
2320 PRINT
2330 GOSUB 3000
2340 LET S2=(W*(X1*(L-X1)))/(Z*L
)
2345 LET V=SQR (((I/3)+(2*X1))/(
3*(L-X1)))*(L-X1)
2350 LET U=(W*X1*(V**3))/(3*E*I*
L)
2360 GOTO 3500
2370 STOP
2400 LET X=4
2410 GOTO 2023
2420 PRINT
2430 GOSUB 3000
2440 LET S2=(W*L)/(2*Z)
2450 LET U=(W*(L**3))/(8*E*I)
2460 GOTO 3500
2470 STOP
2500 LET X=5
2510 GOTO 2026
2520 PRINT
2530 GOSUB 3000
2540 LET S2=(W*L)/Z
2550 LET U=(W*(L**3))/(3*E*I)
2560 GOTO 3500
2570 STOP
2600 LET X=6
2610 GOTO 2034
2620 PRINT
2630 GOSUB 3000
2640 LET S2=(W*L)/(12*Z)
2650 LET U=(W*(L**3))/(384*E*I)
2660 GOTO 3500
2670 STOP
3000 PRINT "W (LOAD IN LBS.)=";
3010 INPUT W
3020 PRINT W
3030 PRINT "L (BEAM LENGTH-IN.)=
";
3040 INPUT L
3050 PRINT L
3060 IF X<>3 THEN GOTO 3100
3070 PRINT "X (DIST-W TO NEAR SU
PP)=";
3080 INPUT X1
3090 PRINT X1
3100 RETURN
3500 PRINT
3502 PRINT "LOAD=";W*L;" IN.LBS.
"
3503 PRINT "SECTION =";D;"X";B;"
X";T
3504 PRINT "MATL. STRENGTH (T)="
;S;" PSI"
3505 PRINT "STRESS (CRIT.PT.)=";
S2;" PSI"
3510 PRINT "DEFL.(CRIT. PT.)=";U
;" IN."
3520 PRINT
3525 IF S2<S THEN GOTO 3650
3530 PRINT
3500 FOR N=1 TO 10
3505 PRINT AT 14,9;"              "
3510 PAUSE 30
3515 PRINT AT 14,9;"[REVERSE]OVERSTRESS[REVERSE]"
3520 PAUSE 60
3530 NEXT N
3550 PRINT
3555 GOTO 1500
9999 STOP
```


A KEYBOARD FOR UNDER $5!?!

Well . . . . . not exactly, but you can have a tactile feedback over lay for $4.95. *This is not just like the one by Kopak Creations*! If you read the premier issue of SQ magazine then you know that their Kopak Creation is too thick for your fingers to fit through the holes and it does not center on the Sinclair computers.

Our vinal overlay is thiner and *does* fit on the ZX-80, ZX-81 or T/S1000. All orders shipped within 3 days and if you are not fully satisfied your full purchase price will be refunded.

FROG SOFTWARE, LTD.
BOX 95, DEPT. K
GLENMONT, NEW YORK 12077

New York residents add 7% sales tax.
To order cod or if you have any questions call (518) 465-6552

***** ZX/TS TOUCH TAB OVERLAY *****

Feel center of keys for positive entry. No visual interference. Pressure sensitive attach quick & easy. Really works. $5.00 and SASE. L-P Overlays, 631 W. Main, Madison, In. 47250.

IMPROVED HEAT SINK for ZX81 & TS1000 eliminates system crashes caused by overheating. $7.95 check/money order or SASE for complete details to:
BASCO, 289 Baxter La, Milford CT 06460

VOYAGER II

The alternative fantasy game. Voyager Fantasy World in search of key to life features split screen display text/map. Ten screens of map 10 x 32. Also has dungeons, cities, and villages. Single Key entry. Price: $9.95. Voyager I still available for $9.95. Other programs available. Send for catalogue.

Horizon Simulation
789 South Green Bay Road
Lake Forest, Il. 60045

72 for L. The screen displays: Total load in inch pounds, a reminder of the section you are testing (2 x 2 x 0.125), the Tensile (29000 PSI), the Stress at the critical point (the center in this case), and the Deflection you can expect at that critical point (about 5/32 of an inch in this case). As you can see, this is a pretty safe load for the selected section.

Now suppose that we want to reduce the cost. Let's try out a small rectangular steel tube. Enter 1 for a new section. Select 2 again, and enter the appropriate dimensions. Let's say that we know the thickness this time: T: .062; D: 1.5; B: .75. Since we already have the rest of our data, we can simply "RECALCulate" by entering 4. As you can see, this substitution results in an equally safe situation.

Encouraged by this, we might try using fewer supports. Let's try 6 chairs on a 12 foot beam. Enter 3 to revise the load. Select 6 again, and enter the load and length: W: 5*320 (you can enter this as an expression and let the computer calculate the result, 1600); L: 12*12 (144).

Lo and behold, we have overdone it. The screen flashes a reverse video "OVERSTRESS" 10 times, because the stress (35009.386) exceeds the tensile strength of the tube (29000 PSI). Under these circumstances, the Deflection data are probably unreliable.

Now let's suppose that you have discovered a miracle material with Tensile strength of 100,000 PSI. Enter this data by returning to 2, the material subroutine. Otherwise, it will not become a part of the new MATERIAL STRENGTH calculation. If you wish to change only the total load applied, get into K mode by entering any letter (giving error 2/1510). Then enter the lighter load with a direct LET statement: "LET W:800", followed by "GOTO 2640". As you can see, we are no longer OVERSTRESSed. If you cannot remember the address of the stress calculation (2640), just go to 1500 to pick up the "BRANCHING" statement that will let you select 4 for recalculation.

Note: Loading diagram 3 (asymmetrical load placement) requires a third dimension "X" to indicate the distance from the load to the nearest support.

With some experimentation, you will develop an excellent sense of which variables have the greatest impact on beam strength and load.

Conclusion

One problem I have not bothered to resolve (because I am awaiting a printer) is remembering the precise details of the section entered in the first steps. If you do not plan to have a printer, you could alter the program to display a simple reminder of the section.

My plans for elaborating the program include a section for calculating compound loading vectors and flags to indicate when stresses approach "proportional limits" and "ultimate strength." You can include safety factors to suit your particular needs by modifying statements in the last few lines. For example, changing line 3525 to 3525 IF S−.8=S2 THEN GOTO 3650 will flag a potential failure at 80% of the ultimate strength level.

Obviously, many of you will not be able to use this particular program directly in your work. However, you may still enjoy working through the program for its graphics and the way the various factors interact in a load carrying situation. Above all, we hope the program will inspire you to use your computer to find a way of taking a "load" off your work.

If any of you architects, designers, engineers, or scientists out there have written programs for the Sinclair computers, I urge you to submit them to *SYNC* so that we can share our efforts and all benefit. ■

Isn't it about time you and your Timex Sinclair *really* got to know each other?

Microcomputer books and software from Wiley Press. We're great at introductions.

WHAT CAN I DO WITH MY TIMEX SINCLAIR 1000? LOTS!

Roger Valentine

Over fifty ready-to-run programs let you do lots more with your 1000 or ZX81 than you ever thought possible—*including 35 programs that run on the 1K and 2K versions.* 160-page paperback plus software cassette $29.90

THE TIMEX SINCLAIR 2000 EXPLORED

Tim Hartnell

Leads you step-by-step through all the 2000's color, sound, and graphics. Features 46 programs, from games to business applications. "Teaches skills which, without its aid might take years to acquire."
—*Clive Sinclair*
Inventor of the Sinclair Microcomputer
224 pp. $12.95

BYTEING DEEPER INTO YOUR TIMEX SINCLAIR 1000

Mark Harrison

Squeeze every bit of computing power from your 1000. Here's step-by-step guidance for programming the Timex Sinclair 1000, plus thirty-seven ready-to-run programs for home, business, and educational applications.
176 pp. $12.95

Wiley microcomputer paperbacks and convenience software can also introduce you to using VisiCalc,® BASIC, COBOL, and more advanced programming techniques. Ask for them at your local computer store or book shop. Or order directly from us with this coupon—and use any program free for 15 days.

For faster service **CALL TOLL FREE:**
800-526-5368.
In New Jersey, call collect:
(201) 797-7809.
Order Code # 3-9870
VISA, MasterCard, American Express accepted on phone orders.

WILEY PRESS
a division of John Wiley & Sons, Inc.
605 Third Avenue, New York, N.Y. 10158

VisiCalc® is a registered trademark of VisiCorp.

Unlocking the power of computing

Please send me the books and/or software indicated to use free for 15 days. If not completely satisfied, I may return them within the trial period and owe nothing. (Restricted to continental U.S. and Canada.)

☐ **Payment enclosed plus sales tax.** Wiley pays normal bookrate postage/handling. We normally ship within 10 days. If shipment cannot be made within 90 days, payment will be refunded. ☐ **Bill me.**

☐ (1-88707-2) Valentine $29.90
☐ (1-89099-5) Hartnell $12.95
☐ (1-89888-0) Harrison $12.95

Please Print

NAME_____
FIRM_____
ADDRESS_____
CITY_____
STATE/ZIP_____
SIGN HERE_____

CREDIT CARD ORDERS: To charge your order plus local sales tax and shipping/handling, fill in the information below. If you are not satisfied with the book or software, return it within 15 days for a full credit to your account.

☐ VISA ☐ MASTERCARD

CARD NO._____
Expiration date_____
Signature

(Offer valid through August 31, 1983.)
Prices subject to change without notice.

Mail to: **Wiley Press**
P.O. Box 092
Somerset, N.J. 08873
092 3-9870

Get serious about ZX81 & TS 1000 Computing

Cassette Software

ZX FORTH

A complete implementation of the FORTH language for the ZX81 and TS1000 computer.
FORTH's most distinctive feature is its flexibility. The basic unit is the word — the programmer uses existing words to define his own which can then be used in further definitions. FORTH is a compiled language so programs run very fast (typically five times faster than BASIC).
ZX-FORTH is supplied on cassette and is accompanied by extensive documentation:
56-page Users Manual
8-page Editor Manual

Z43 $29.95

ZX BUG

Machine Code Monitor and Disassembler
ZXBUG is a powerful tool for machine language programming. It is 4K long and uses memory from 71EO to the top memory. ZX BUG works in hexadecimal (base 16), not decimal, so all addresses are a maximum of 4 Hex bits long. Provides a total of 28 commands.

Z41 $14.95

ZX Assembler

This Machine Code program occupies 7K of memory and locates itself at the top of memory. The program is a full Editor/Assembler and Monitor. Labels may be used instead of any string. The features include Line Insertion/Delete, Insert Characters, Auto Repeat on all keys. The monitor has facilities to inspect memory, registers and run machine code programs.

Z40 $14.95

TOOLKIT 9 Powerful New Functions!

RENUMBER. This routine renumbers a program in any step and from any line up to 9999
DELETE. This command deletes a group of lines in a program.
MEMORY. Prints how much spare memory is available.
DUMP. Displays current values of string and numerical values, except arrays.
FIND. Will find any string of up to 255 characters and list each line containing that string.
REPLACE. Replaces any string of up to 255 characters by any other string.
SAVE. Transfers program in computer to below RAMTOP.
APPEND. Allows two programs to be joined.
REMKILL. Removes all REM statements from a program, otherwise leaving it unchanged, preserving memory.

Z42 $14.95

Z-AID 1.0

Includes the following routines:
VERIFY confirms whether a program has been recorded properly on tape. The program in memory is unaffected, and a further "save" can be made if necessary.
Mload/Msave enables a specified block of memory to be saved. VPTR can be used within a BASIC program to eliminate many tedious POKEs and PEEKs in finding the addresses where variable values are stored.
CHAIN allows the second part of a BASIC program to be loaded and tacked onto the end of the first part.
Z-AID 1.0 is convenient to use, being loaded from tape, and residing at the top of 16K memory. The user accesses the various routines with USR calls while loading, running, editing and saving BASIC programs normally.

Z98 $14.95

ZX TS Fastload™

Z61 $19.95

- ★ Allows you to LOAD and SAVE ZX81 programs up to 6 TIMES FASTER!
- ★ Easy-to-use in your own programs.
- ★ User-transparent when incorporated into programs.
- ★ Verifies proper loading.
- ★ Catalogue feature lists program names and memory usage.
- ★ LOADER occupies less than 500 bytes (½ K) of RAM.
- ★ Consists of 2 separate programs — KEYBOARD MONITOR and FAST LOADER.
- ★ Supplied on cassette with extensive documentation.

KEYBOARD MONITOR is a user-friendly BASIC program which gives such information as the speed at which the tape was recorded, file name, file type, number of bytes in file, and whether a read error occured. If desired, the user-friendly portion of the program can be removed for direct access to Machine Code Monitor. Both parts reside at RAMTOP and are user transparent. Full details are given in the manual for fast saving of your program.

FAST LOADER also resides above RAMTOP and can be used in front of any fast-saved program to enable it to be fast-loaded. This removes the need to load the monitor for each load.
Reliability and compatability: Fast-Load is an exceptionally reliable system. In one 3 hour test, over 1,300,000 bytes of data were recorded and then read without error, using a low cost cassette player. Compatible with all ZX81 systems, at your choice of two operating speeds: Medium Speed (4 times faster) suitable for use with any tape recorder that works with ZX81; Fast speed (6 times faster) for most higher quality tape recorders.

The Complete ZX81 and TS1000 Library!

BOOKS

The Complete ZX81 Basic Course Includes	B70
Basic Course Cassettes (2)	$29.95
Getting Acquainted with your ZX81	C70 $8.95
ZX81 Pocket Book	P70 $10.95
Making the Most of Your ZX81	P71 $10.95
Computer for Kids, ZX81 Edition	C71 $4.95
Explorers Guide to the ZX81	T70 $12.95
ZX81 Companion	C72 $8.95
49 Exploding Games for the ZX81	P72 $10.95
Not Only 30 Programs for ZX81 : 1K	B72 $9.95
Machine Language Made Simple	B73 $14.95
Mastering Machine Code on your ZX81	P73 $12.95
ZX81 Rom Disassembly: Part A	Both for
ZX81 Rom Disassembly: Part B	$19.95
Understanding your ZX81 ROM	B76 $14.95

CALL OR WRITE FOR FREE CATALOG

KEYBOARD

with metal case K71

$99.95

A full-sized professional keyboard for the ZX81 Features 47 keys and a full-sized space bar. Connects to the ZX81 with no soldering required, via a plug-in flexible connector. You can purchase the keyboard only, or the optional metal case that holds both keyboard and ZX81. Expansion devices (i.e. RAM packs, etc) connect to the ZX81 edge-connector which extends from the rear of the cabinet.
A professional keyboard makes program entry easier and less error-prone.

Keyboard K70 $79.95
Metal case for keyboard and ZX81 E70 $25.00

GLADSTONE 16K RAM

Equivalent in performance to Times Sinclair RAM.
G16 $149.95

64K RAM

Expands the capacity of the T/S 1000 or ZX81 to its maximum. User transparent. **G64 $149.95**

Coming soon: **32K RAM** PIGGY-BACK
Can be used as a stand-along memory, or in conjunction with 16K (Timex Sinclair, Gladstone, or any other) to give a total memory of 48K. **G32 $99.95**

MEMORIES

CRAMIC-81 16K CMOS RAM

NEW RAM PACK STORES 16K EVEN WITH POWER SWITCHED OFF
CRAMIC-81 is a 16K RAM pack using CMOS technology for permanent data retention. Data can be stored almost indefinitely and loaded almost instantly with virtually zero chance of erro.

CRAMIC-81 module uses chips made in a special CMOS technology which require only a tiny amount of power to retain data when not actually in operation. A state-of-the-art, long life (10 years) lithium battery supplies this power in the standby mode. In the active mode, power is taken from the ZX81. Used on its own it behaves like an ordinary Rampack EXCEPT that it can be powered down and removed. Program and data in it is permanently stored when this is done.

An ordinary Rampack can also be connected simultaneously. The two RAM units then occupy the same memory area but either can be selected. Two separate programs can actualy run alternately.

CRAMIC-81 comes in an elegantly molded lie-flat case with a cabled connector.

C12 $179.95

GLADSTONE ELECTRONICS

In N.Y. (716) 874-5510
Toll free (800) 833-8400

Mail order to 1585 Kenmore Ave. Buffalo N.Y. 14217 Checks or money orders. No CODs. Add shipping

GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS

Understanding Number Systems

James R. Avoli

This explanation of number systems was written to explain the working of my home computer to my son. It is all too easy to destroy enthusiasm for learning by trying to teach a technical subject from generalizations (boring) or from technical terms (confusing); either way can be self-defeating.

So let's begin with the definitions of three terms that will be used heavily: 1) a *numeral* is a figure that represents a number; 2) a *digit* is any of the numerals in a number; and 3) a *value* is the total amount represented by numbers.

We humans use *ten* numerals in our everyday life because we count on our ten fingers. We refer to values created from the base ten, i.e., the *decimal* number system. We need to take great care to understand the concept of the zero i.e., no fingers: it is a valid numeral in all number systems, and it is the only numeral that can be a place-holder, i.e., represents no value. Also undertand the foresight of the ancient mathematicians in *not* counting from one through ten with a single digit.

James R. Avoli, 239 Foxcroft Rd., Pittsburgh, PA 15220.

Modern electrical devices, from switches to digital computers, can represent only *two* values: electrical energy is either off (represented by the numeral zero), or on (represented by the numeral one). We refer to values created from these two numerals as being in the base two, i.e., the *binary* number system. This dual-state concept is known as *digital*, and is illustrated in Figure 1. Another concept, known as *analog* and illustrated in Figure 2, can represent *all* the values between fully off and fully on. At any instant in time, a digital signal is either off or on, while an analog signal can be anywhere between off and on. An example of an analog device is an amplifier. We shall discuss analog concepts no further, but you should be aware of the antithesis of digital.

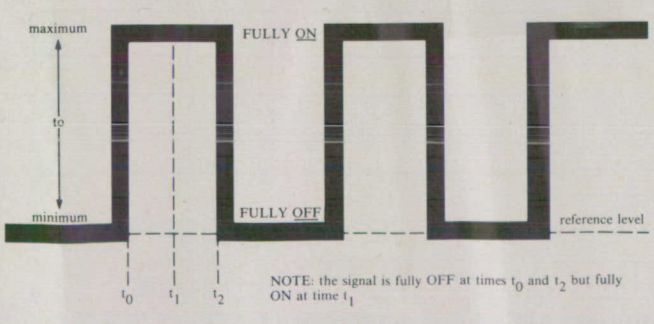
Computer professionals began to use the base eight (the *octal* number system) and the base sixteen (the *hexadecimal* number system) because binary values can be difficult for the human brain to interpret if there are too many digits. The binary digits, dubbed *bits* by these same computer professionals, are grouped together into logical units of three bits of octal (from the days of 24-bit computers), or into four bits for hexadecimal (for today's 8-, 16-, and 32-bit computers). Table 1 is a visual comparison of parts of the basic number systems that we have discussed. See that we can represent zero through seven with three bits, and zero through fifteen with four bits.

As in our familiar decimal number system, notice that no single digit in any number system can have a value equal to (or greater than) the number system itself, because the value zero is included as a valid numeral. For example, our decimal number system represents the values zero through nine; the hexadecimal number system represents the values zero through fifteen. This phenomenon brings us to our next-to-last math fact we need to understand number systems: we must use some special characters as numerals to represent values greater than nine in a single digit. Since the logical sequence of the alphabet is easy enough to remember, *A* represents ten, *B* represents eleven, and so forth as shown in Table 1. With these basics of the binary number system in hand, our next step is to do something with it.

Table 1.

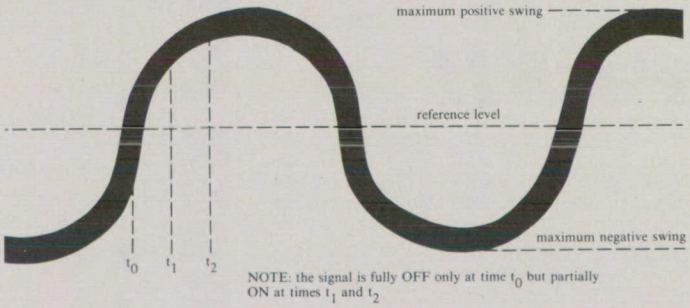
Binary (2)	Octal (8)	Decimal (10)	Hexadecimal (16)
0	0	0	0
1	1	1	1
10	2	2	2
11	3	3	3
100	4	4	4
101	5	5	5
110	6	6	6
111	7	7	7
1000	10	8	8
1001	11	9	9
1010	12	10	A
1011	13	11	B
1100	14	12	C
1101	15	13	D
1110	16	14	E
1111	17	15	F

Figure 1. Illustration of DIGITAL.



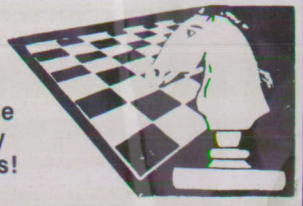
NOTE: the signal is fully OFF at times t_0 and t_2 but fully ON at time t_1

Figure 2. Illustration of ANALOG.



NOTE: the signal is fully OFF only at time t_0 but partially ON at times t_1 and t_2

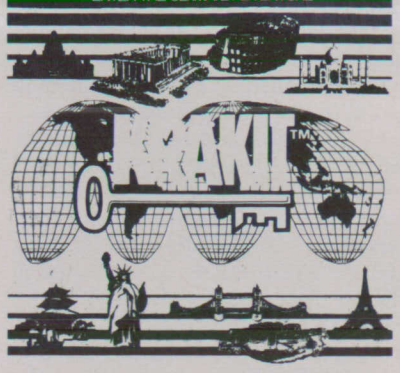
Have fun with ZX81 & TS 1000 Computing



Now choose from many great games!

TS1000-ZX81 OWNERS WIN $20,000

ENTER THE ULTIMATE ADVENTURE



Z48 $19.95

KRAKIT™ consists of 12 clues on a ready-to-run ZX81 or TS 1000 cassette tape (16k RAM). The answer to each clue is the name of a country, a city or town, and a number. If you are the first qualified entrant to solve all 12 clues and declared the winner, you receive two tickets to the city of the secret KRAKIT™ vault location. When you arrive at that location, a cheque for a minimum amount of $20,000.00 (U.S.) will be presented to you. The amount of the prize money is augmented weekly.

BUSINESS Pack 1

Contains 2 tapes with an instruction/applications manual with the following programs:

BREAK EVEN ANALYSIS: Enter expense items by name. Enter revenue items by name. Enter fixed costs and variable costs. Calculate break even point and plot expense and revenue curves. Backward calculation by setting breakeven point quantity, expense or revenue.

CASH FLOW ANALYSIS: Enter income and expense items. Calculate net income. Calculate discounted cash flow — PV and NPV. Plot NPV for various interest rates.

PAYBACK ANALYSIS: Enter expense and revenue items. Calculate years to payback.

INTERNAL RATE OF RETURN: Enter expense and revenue items. Display net cash flow. Calculate IRR.

DEPRECIATION ANALYSIS: Enter depreciable amount. Select depreciation method and enter parameters. Calculate depreciation by any currently allowed method.

Z49 $29.95

Pack II

PROJECT SCHEDULER: Record project est. hours, hours to date, remaining hours. Record billing rate, employees involved. Display amount billed, current billing, estimated billing remaining.

PROPOSAL SHEET: Record work items and hours. Record hourly billing rates. Display overheads, material cost and labor totals.

Z50 $ 14.95

CANADA: PRICES MAY VARY

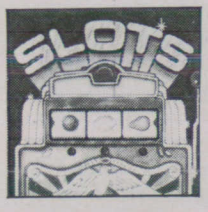
GAMES

Pilot your space craft through a fast moving, complex space maze. Watch out for missiles being fired from all directions. You can shoot back or evade them. Written in machine code for fast-paced excitement.

Z90 $14.95

Blackjack at its best. Blackjack as it played in the casinos of Nevada. Up to five players can play against a dealer with a fifty-two card deck. Split pairs, double down, and even buy insurance. The deck is reshuffled only when needed — allows for a continuous game. Your winnings and losings are displayed after each hand.

Z88 $9.95



Here is your chance to beat the 'one-arm bandits'. Slotslets you choose 5¢, 10¢, 25¢, 50¢ and even $1.00 machine. Each machine has six sets of different graphics and pay according to the number of coins you played. Excellent, striking graphics, and lots of fun and excitment.

Z89 $9.95

GALAXY INVADERS

An excellent version of the classic space game. Protect your seven lives against fleets of hostile invaders, who swoop down and attack quickly. This version is an excellent demonstration of the capabilities of the ZX81 or TS1000 to entertain and excite for hours.

Z91 $14.95

ZX CHESS (Enhanced)

Full graphic display of chess board. Six levels of play, two of which play within competitive time limits. You choose black or white. Plays all legal moves including castling and en-passant. You can save games in progress on cassette. Displays moves of game on screen, or output yo printer, for analysis. Board can be set up in any position, you can even change sides mid-game. Clear entire board with one command: for end game analysis. Written totally in machine code, ZX CHESS (Enhanced) is a superb game for the advanced chess player.

Z85 $14.95

ZX CHESS II (CHESS MASTER)

The strongest chess game available on ZX81. ZXCHESS II has not ben beaten. All the features of ZX CHESS (Enhanced), plus much more. Has a book of 32 opening moves. Can play at 7 levels, four of which play within competition time limits. A move is suggested by the ZX81 if requested.

Z86 $24.95

1K ZX CHESS

A good introduction to chess for 1K ZX81/TS1000 owners. Even within this limited memory space, a full graphic representation of the chess board is included. Single level of play. Does not accept castling or en-passant moves.

Z87 $9.95

2K Chess (T/S 1000)

(for unexpanded T/S 1000) Improved Chess game for an unexpanded T/S 1000. Better graphics and a vastly superior range of moves.

Z55 $14.95

Your ZX81 becomes the command console as a diver descends to the sunken submarine Nautius to rescue as many of the stranded crew as possible. It's a race against time as your oxygen supply must be replenished. It's also a constant battle against marauding sharks which you can attempt to blast with your laser.

Z96 $9.95

'ZX-Galaxians is a good adaption to the ZX81 of the popular arcade game of the same name. You are being attacked in deep space by formations of hostile Galaxians, and it is your mission to prevent them from attacking Earth by zapping them with your laser gun as they break out of formation and hurtle towards you. . . .

Z72 $ 14.95

GLADSTONE ELECTRONICS

In N.Y. Call (716) 874-5510 Toll Free (800) 833-8400

ORDER FORM

CHARGE TO: ☐ VISA ☐ MASTERCARD

account number

Expiry date

Signature

Date

Please rush me:

Quantity	Price	Total

NAME _____ New York Res. add sales tax

ADDRESS _____ SHIPPING

CITY: _____ STATE: _____ ZIP: _____ TOTAL

To: Gladstone Electronics, 1585 Kenmore Ave., Buffalo N.Y. 14217

Call or write for free TS1000 & ZX81 catalog

SY283

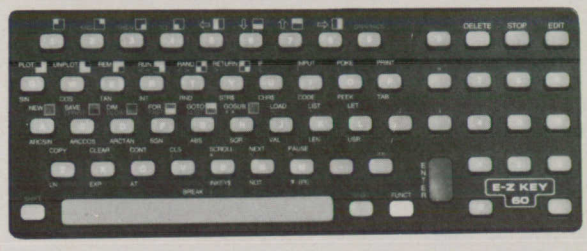
GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS GLADSTONE ELECTRONICS

Join the CLICK!

Enter your programs Faster & Easier with the E-Z Keyboard . . .

At last, a large 60 key "Tactile Feel" keyboard that plugs into the same connectors as the existing keyboard on your ZX81 or your Timex-Sinclair 1000.

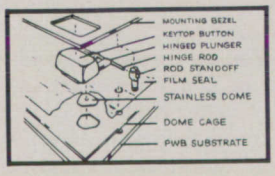
Hear the CLICK and feel a SNAP for every key pressed! (Tactile Feedback).



E-Z Key 60 has the following features:

- 60 Keys - Legends in 3 colors on the base
- Molded legends on key tops
- 8 Automatic shift keys (no shifting required) for edit, delite, single and double quotes, colon, semi-colon, function and stop.
- 2 Shift keys - **Numeric key pad** - 5" space bar.

E-Z Key 60 requires no wiring (just plug it in) and can be adapted to fit the XZ80 or the MicroAce (8 KROM). The Mounting base measures 10"x4". Cables and instructions are included.



SWITCH SPECIFICATIONS:

Key tops measure .4" x .3" - spaced at ¾" intervals between keys. Life = 10 million operations, typical. Force = 3. oz. Travel = .040". Dome switch, button type with arm to give .040" travel.

Only

$84.95

A custom made enclosure (shown above) is also available for your computer and E-Z Key 60 keyboard.

Measurements:	Price:
EC-11 11"x9"x3"	$25.00
EC-14 14"x9"x3"	$30.00

WATCH FOR THESE NEW PRODUCTS!

JOYSTICK: Joystick kit that requires no wiring and will fuction like the arrow keys & Ø on your computer.

E-Z Key 40 Replacement flat keyboard with embosing around each switch and 3 color legends and graphics as existing keyboard (plug in replacement).

Delivery 4-6 weeks. 90 day warranty.

USE THIS ORDER FORM...

☐ Check or Money Order

Charge to my:
☐ Visa ☐ Mastercard

Card # _____

Expires _____

	Quantity	Unit Price	Total
E-Z Key 60		$84.95	
EC-11/14		$25/$30	
Total units S&H $4 per unit			
Mass. res. add 5% sales tax			
Total			

Send to:

E-Z KEY
Suite 75 A
711 Southern Artery
Quincy, MA 02169

Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

E-Z KEY

SUITE 75 A, 711 SOUTHERN ARTERY
QUINCY, MASSACHUSETTS 02169
(617) 773-1187

First, we must understand the mechanical process used to construct a value exceeding one digit. We simply add up how many times each exponent of the number system can fit into the whole value. To demonstrate what this final math fact means, let's work through some examples after we review a few rules about exponents:

— a number raised to the power of zero yields one (e.g., $X^0 = 1$);
— a number raised to the power of one yields itself (e.g., $X^1 = X$);
— a number raised to a fractional power yields a root (e.g., $X^{1/2} = \sqrt{x}$).
— a number raised to a negative power yields an inverse (e.g., $X^{-1/2} = 1/\sqrt{x}$).

Now we can work on some examples. To an English speaking human, the words "four thousand ninety-six" has been drilled to mean the following:

4 times 1000 (10^3), plus
0 times 100 (10^2), plus
9 times 10 (10^1), plus
6 times 1 (10^{00} for a total of 4096 in the base ten. This information can be shown in tabular form as follows:

10^3	10^2	10^1	10^0
1000	100	10	1
4	0	9	6

The mechanics of this example must be perfectly clear to you before we proceed. If you are not sure, think "how many times will this exponent's value for this digit fit into the current remainder?"

4096/1000 = 4 (remainder 96)
96/ 100 = 0 (remainder 96)
96/ 10 = 9 (remainder 6)
6/ 1 = 6 (no remainder)

Further examples of the same value, but expressed in different number systems, demonstrate the link between the logical grouping of four bits we described earlier.

Isn't it easier to say "one zero zero zero hex" than "one zero zero zero zero zero zero zero zero zero zero zero zero zero zero binary"?

Now, you try it for the base eight. HINT: first fill in the exponent values, then begin dividing the decimal value (4096) by the largest octal value.

_____times_____(8^4), plus
_____times_____(8^3), plus
_____times_____(8^2), plus
_____times_____(8^1), plus
_____times_____(8^0), for a total of
_____in the base eight.

Now that we have the basics and the mechanics of different number systems under control, let's mount one final assault in a similar direction. So far, our examples have represented *internal* digital values, i.e., values upon which a human or machine can perform arithmetic functions directly. There is one more number system by which *external* input and output devices, such as thumbwheel switches and seven-segment displays, can be connected to logical devices directly; their data representations also can be used directly. An example of a representation that cannot be used directly is the holes punched in a card column.

Computer professionals have defined a *register* as a circuit that holds several adjacent digits which are to be treated as a unit. In the base two, if all the bits are set on (i.e., to ones), you can see that a sixteen bit register would represent 1111 1111 1111 1111, or 2^{16}-1 or 65,535 in the base ten, or FFFF in the base sixteen.

Now, combining all that we have learned so far, we can understand why the logical representation of binary digits (to the electrical device) and decimal digits (to the human brain), is called *binary coded decimal,* or simply BCD. Although it sounds formidable, BCD simply refers to a number system by which a decimal numeral (zero through nine) is represented by a group of four bits called a *nibble.*

Therefore, our continuing example of "four thousand ninety-six" becomes represented as in Table 2.

Table 2.

(four digit BCD register)

external digit values	4	0	9	6	
internal BCD values	0100	0000	1001	0110	(four bit nibbles)

(sixteen bit register).

Binary	Hexadecimal
1 times 4096 (2^{12}), plus	1 times 4096 (16^3), plus
0 times 2048 (2^{11}), plus	
0 times 1024 (2^{10}), plus	0 times 256 (16^2), plus
0 times 512 (2^9), plus	
0 times 256 (2^8), plus	0 times 16 (16^1), plus
0 times 128 (2^7), plus	
0 times 64 (2^6), plus	
0 times 32 (2^5), plus	
0 times 16 (2^4), plus	0 times 1 (16^0) for a total of
0 times 9 (2^3), plus	
0 times 4 (2^2), plus	
0 times 2 (2^1), plus	
0 times 1 (2^0) for a total of	

1	0	0	0	in the base sixteen.
1	0000	0000	0000	in the base two.

Prove this relationship to yourself by reviewing each digit's representation in Table 1. You can now appreciate why the biggest BCD number that can fit in a sixteen bit register is 9999.

In conclusion, if you have worked through the examples, it must be clear by now that any internal or external value can be converted from any number system to any other number system. You can do it, now that you understand the true meaning of each digit, and the conversion process between number systems. You proved it by computing the total of 10,000 in the octal exercise. Congratulations! ■

CHANGE YOUR TIMEX/SINCLAIR 1000 DISPLAY TO FULL COLOUR GRAPHICS with

KOLORWORKS

LOOK AT THE FEATURES !!!

- Plugs into ZX81/1000 (edge connector)
- Latest technology with TMS9918 VDP (32 sprite levels)
- Module contains it's own memory
- All text will run on the color tv
- User defined characters & graphics up to 256x192 pixels
- Module contains extension of basic commands including: PAPER/INK/ BORDER/BIN/SPRITE/OUT/INP/etc.

for $149.95

KOLORWORKS COMES WITH A LIMITED WARRANTY ON PARTS AND WORKMANSHIP

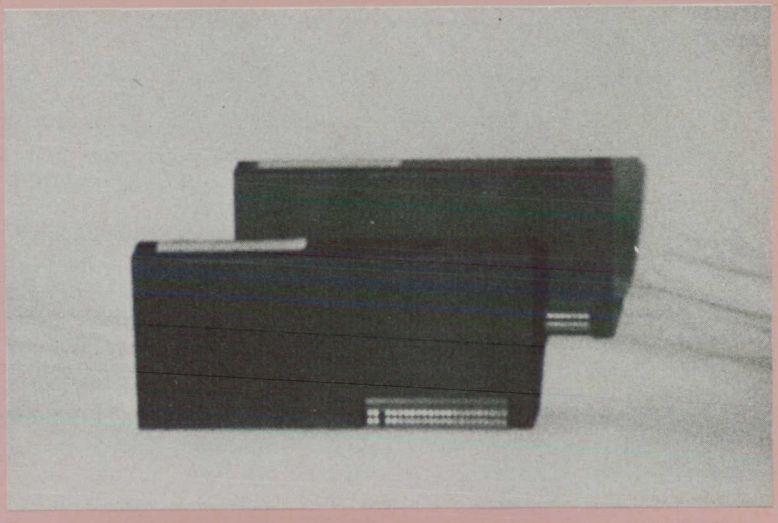
USE YOUR KOLORWORKS IMMEDIATELY WITH A GAME CASSETTE FOR $9.95

This delightful game is designed for hours of fun using some of the color graphic capabilities of KOLORWORKS. The cassette also contains a short program to familiarize you with some of the commands and graphics.

Enjoy Game Fun With

GAAMWORKS

THE SOON TO BE RELEASED GAME MODULE (proto-type stage) WILL OFFER SOUND, ROM CARTRIDGES AND JOY STICK PORTS FOR YOUR TS1000/ZX81.



- **THE SOUND** will be of arcade game quality which you can program for music, animals, transportation (auto, train, airplane, etc.) and machine sounds.
- **ROM CARTRIDGES** will have up to 8K of ROM using either 2716, 2732 or 2764 EPROMS. We will have pre-programed cartridges and blank cartridges which you can program. We will be offering a service to burn EPROMS from your cassettes.
- **JOY STICK PORTS** will allow for the use of two "Atari"®compatible joy sticks.

SORRY PRICE IS NOT AVAILABLE AT THIS TIME! GAAMWORKS WILL BE AVAILABLE BY MAIL ORDER STARTING MARCH 1st. FOR FURTHER INFORMATION, SEND $2.00 (Credited to Order).

At this time KOLORWORKS and GAAMWORKS is available only by mail order.

MAIL TO: **BRAINCHILD COMPUTER WORKS, INC.**
P.O. Box 506
Pewaukee, WI 53072

	PRICE	QTY.	AMOUNT
KOLORWORKS	$149.95		
CASSETTE	9.95		
Shipping & Handling	4.95		4.95
Wi. residents add sales tax	TAX		
	TOTAL		
My ☐check ☐ money order is enclosed	ENCLOSED		

Name _____

Street _____

City _____ **State** _____ **Zip** _____

Please allow six to eight weeks for processing. Thank you.

8K ROM; 1K RAM
4K ROM; 1K RAM

Looping the Loop

Harry Doakes

Maybe you have noticed that very short machine code routines do not seem to work much faster than Basic. There is a reason for that—if it is short and simple. Basic can often do it almost as fast as machine code. Since there is a lot of extra work involved in writing a machine code routine, it hardly seems worth the effort.

But the longer and more complicated the job is, the longer it takes in Basic—and the more you can see the speed advantage of machine code. The question is, how can you do long, complicated jobs using machines code—without having to write long, complicated *programs* in machine code?

The answer, in a word: loops.

How's That Again?

The real power of a computer comes into play when you want to do something over and over. For example, it is not much work to multiply 7 times 5. It probably takes most people longer to type

```
PRINT 7*5
```

than it does to figure out that 35 is the answer.

But suppose you want to multiply 7 by each number from, say, 1 to 30. One way to do it is to write a long program that does one multiplication in each line—something like this:

```
10 PRINT 7*1
20 PRINT 7*2
30 PRINT 7*3
40 PRINT 7*4
```

...and so on. You could multiply numbers by 7 as high as you wanted to go, taking one line for each multiplication.

Harry Doakes, PO Box 10860, Chicago, IL 60610.

But you can get the same results in Basic with a program that is just 4 lines long, no matter how many times you want to multiply. The trick is getting the computer to do the same thing again and again:

```
10 LET A=1
20 PRINT 7*A
30 LET A=A+1
40 GO TO 20
```

If you enter and run this program, you will get more than 20 answers—without a lot of typing.

Making the Big Jump

The GO TO command in Basic is used to form a *loop*. That means the computer repeats a group of lines more than once, with only slight differences each time through.

As you might guess, there is a Z80 machine code instruction that works exactly the same way GO TO does. It is called the *jump* instruction, abreviated "JP". Just as the Basic GO TO causes the program to go to a particular line, the jump instruction makes the Z80 processor go immediately to a particular part of the machine code program. It is not a line number, though (remember, machine code programs do not have line numbers), but a particular byte of memory.

In other words, you can translate a Basic GO TO directly into a machine code jump—*if* you know the memory location you want it to jump to. For example,

```
10 LET A=0
20 LET A=A+1
30 GO TO 20
```

becomes

```
      LD A,0
LOOP: ADD A,1
      JP LOOP
```

"Loop," of course, is just a "dummy" name. When you convert the machine code routine into the numbers the computer will understand, you have to know exactly what memory location the "ADD A,1" instruction begins at.

Maybe that sounds complicated. It is not really; after all, eventually you will have to figure out where the machine code routine will go in memory anyway. Suppose our simple loop routine starts at location 17000. Then it sets up something like this:

```
17000   LD A,0      62,0,
17002   ADD A,1     198,1,
17004   JP 17002    195,106,66
```

The numbers in the right-hand column are the numeric codes that will actually go into the computer. You can check each of them by looking in the back of your ZX81 or T/S 1000 manual, in the appendix titled "The Character Set." "LD A,N" is 62 (and the number to load into register A is 0). "ADD A,N" is 198, and what you are adding is 1. Finally, "JP" is 195. The two numbers that follow are the memory location 17002.

Remember, a byte of memory can only hold a number between 0 and 255. When you make a larger number—such as a memory location—part of a program, you have to fit it into two bytes. First, divide the number by 256; then the *remainder* goes in the first byte, and the *quotient* goes in the second. 17002 divided by 256 is 66 with 106 remainder, so "JP 17002" becomes the three numbers 195,106,66.)

One Small Step Backwards

There is also another kind of jump instruction—and there is nothing in Basic quite like it. It is called a *relative jump*, but you might think of it as a "jump forward or backward" instruction.

Suppose you had a Basic command that would let you "go back" a few lines. You would not have to know the number of the line to GO TO in our simple loop program. You would simply tell the program to "go back one line":

```
10 LET A=0
20 LET A=A+1
30 GO BACK 1
```

It does not exist in Basic—but in machine code, it does. The *jump relative* instruction is abbreviated "JR", and the

NEW! 7 NEW Handbooks for your Sinclair ZX-81 or Timex-Sinclair 1000!

THE EXPLORER'S GUIDE TO THE ZX-81 AND TIMEX SINCLAIR 1000
by Mike Lord

Here is the first truly advanced guide that will help you use your ZX-81 to its fullest potential. You'll find new features of BASIC, new machine code programming tips and elements of the ROM, 30 games and other programs, application routines, hardware tips, how to add a fullstroke keyboard, and much more!

FIFTY 1K/2K GAMES FOR THE ZX-81 AND TIMEX SINCLAIR 1000
by Alastair Gourlay, James Walsh and Paul Holmes

New! The most complete selection of games ever designed for the Sinclair ZX-81 and Timex 1000 personal computers. By using the programs in this guide, you can play all your favorite arcade games in moments. Dogfight, Breakout, Outlaw, Galaxian, Roadracer, Alien Invasion, and dozens more—all complete in this new game guidebook!

SELF-TEACHING SOFTWARE FOR THE ZX-81 AND TIMEX SINCLAIR 1000
Mathematics I-VI
by Joseph R. Gladstone

Now you can get the learning advantage! Children ages 5-12 will find basic skill instruction and numerous practice programs. Each package contains 2 casette tapes with 32 lessons, games and activities. And ... this newly designed classroom aid comes handsomely packaged in a durable vinyl binder!

MAKING THE MOST OF YOUR ZX-81
by Tim Hartnell

This brand-new handbook focuses on the additional features of your ZX-81.You'll have new games and useful learning tricks, and you'll also see how to write programs that really work! It will guide you through start to finish, using each feature and function of your new ZX-81 personal home computer.

MASTERING MACHINE CODE ON YOUR ZX-81
by Toni Baker

Using this guide you'll learn the ins and outs of ZX machine code translation. Discover the secrets of the ZX-81 ... see how to adapt the code to a ZX-80 machine. When you understand the language translations between BASIC and the ZX machine code, you'll enjoy the workings of your computer to the utmost!

49 EXPLOSIVE GAMES FOR THE ZX-81
Edited by Tim Hartnell

Galactic Intruders, Breakout, Checkers, Death Maze, Smuggler's Mold, and forty-three other favorites are all here, newly adapted for your new ZX-81 personal computer. This fascinating gamebook gives you programming instructions for all 49 marvelous games PLUS complete and easy-to-understand game rules.

THE ZX-81 POCKET BOOK
by Trevor Toms

Now, you can create your own programs and understand why they work. You'll see what your new ZX-81 can do, and what extras will make it able to do even more ... see how to use new ZX-81 BASIC in the best ways ... learn to avoid frustration and retyping with program and data file storage and retrieval techniques. PLUS, you'll learn how to convert your ZX-80 to the advanced ZX-81 capabilities.

Send to: Reston Publishing Company, In care of: Prentice-Hall, Inc., Book Distribution Center, Rte. 59 at Brook Hill Drive, West Nyack, New York 10995.

Please send me my 15-day trial copies of the following titles:

_____ **THE EXPLORER'S GUIDE TO THE ZX-81 AND TIMEX SINCLAIR 1000,** by Mike Lord, (R1815-1), $18.95

_____ **FIFTY 1K/2K GAMES FOR THE ZX-81 AND TIMEX SINCLAIR 1000,** by Alastair Gourlay, James Walsh, and Paul Holmes, (R1979-5), $16.95

* **SELF-TEACHING SOFTWARE FOR THE ZX-81 AND TIMEX SINCLAIR 1000: I-VI,** by Joseph R. Gladstone, **Mathematics 1,** (R6966-7), $29.95_____
Mathematics 2, (R6967-5), $29.95_____ **Mathematics 3,** (R6968-3) $29.95_____
Mathematics 4, (R6970-9), $29.95_____ **Mathematics 5,** (R6971-7, $29.95_____
Mathematics 6, (R6972-5), $29.95_____.

_____ **MASTERING MACHINE CODE ON YOUR ZX-81,** by Toni Baker, (R4262-3), $18.95

_____ **49 EXPLOSIVE GAMES FOR THE ZX-81,** by Trevor Toms, (R2087-6), $17.95

_____ **MAKING THE MOST OF YOUR ZX-81,** by Tim Hartnell, (4189-8), $16.95

Name _____

Address _____

City _____ State _____ Zip _____

Now you can charge your orders! Visa ☐ Mastercharge ☐

Account No. _____ Expiration Date _____

Signature _____

Save: If check or money order, plus your state's sales tax, accompanies your order, publisher pays all postage and handling charges. Same money back offer applies.
Dept. V.

V-0893-1B-(3)

best way to see how it works is to rewrite our simple loop using it:

```
17000    LD A,0        62,0,
17002    ADD A,1       198,1,
17004    JR-4          24,-4
```

See the difference? With "JR" you do not have to worry about the remainder and the quotient and dividing by 256. You just tell the processor to "go back 4 bytes." No matter where you put this routine in memory, it will always work properly. Unlike the "jp" version, it doesn't have to start at 17000; it can be moved anywhere in memory without being changed.

Why is the instruction "go back 4 bytes" instead of, say, "go back 2 bytes"? Well, the Z80 processor reads the whole instruction first, *then* does what it is told. When it get to the "JP -4" instruction, first it reads the whole instruction—"24,-4". Then it goes back 4 bytes. Going backwards, the first byte is "-4". Then comes "24", then "1", then finally it gets to "198", which is where it starts to work again—the beginning of the "ADD A,1" instruction.

If it were just "JR -2", the processor would go back to the beginning of the jump instruction—something like

```
40 GO TO 40
```

in Basic. It would just keeping coming back to itself. If the instruction were "JR 0" then the processor would not go back at all—it would just continue with the next instruction.

There is a disadvantage to the "JR" instruction—you cannot use it to go back (or forward) more than 127 bytes in your program. But for most machine code routines, that is plenty of room to work with—and if you have to take a bigger step than that, you can always use a "JP" instruction.

Around and Around and...

There is another problem with using a jump instruction to make a loop. If you enter and run the Basic "multiply by 7" loop, you will notice that the program stops only when the screen fills up and you get an error message. There are not any error messages in machine code—so, given a chance, the machine code routines we have just described will keep running forever, or at least until you pull the plug of the computer. That is not very helpful.

The solution: put a limit on the loop by choosing a point at which you want it to stop. For example, you can change the Basic version of the program to look like this:

```
10 LET A=1
20 PRINT 7*A
30 LET A=A+1
40 IF NOT (A=16) THEN GO TO 20
```

Each time the program goes through the loop, variable A gets higher. When the program hits line 40, it will GO TO line 20—as long as A is less than 16. Finally, after printing 15 numbers, A equals 16, and the computer *will not* GO TO 20—instead, it drops out of the loop, and the program ends. There is no more endless loop—and you do not need an error message to stop it any more.

Can we do it in machine code? Yes, but it is just a little tricky. In Z80 machine code, there is no single instruction exactly like the IF...THEN in Basic. The Basic command

```
40 IF NOT (A=16) THEN GO TO 20
```

becomes two machine code instructions: "compare what is in register A to 16, and, if it is not the same, then jump to the beginning of the loop." That is abbreviated as

```
CP 16
JP NZ,LOOP
```

It is *two* instructions, one right after the other.

How can the computer make two separate instructions work together this way? It keeps track of what is going on by using *flags*.

Six Flags over Z80

Almost every time the computer performs a machine code instruction, it takes notes on what has happened. For example, after an "ADD A,N" or "SUB A,N" instruction, the processor notices whether the result was zero, or less than zero, or greater than 255, among other things. (It ignores a few kinds of instructions—for example, it does not take notes on the "load" instructions at all.)

The computer keeps track of all these things in a special "scratch-pad" register called the *flag register*. There are six flags that go up or down, depending on the result of the instruction. For example, when a "SUB A,B" instruction leaves a zero in register A, the "zero" flag goes up; if the result is not a zero, the zero flag comes down.

You can make a jump instruction depend on whether a particular flag is up or down.

To send the flag up or down in our loop, we will test the value in register A with a "compare" instruction. "Compare" is abbreviated "CP"; it compares what is in register A to some other number. For example,

```
CP B
```

will compare the value in register A with the value in register B.

```
CP 23
```

compares the value in register A with the number 23.

How does the processor compare them? It *subtracts* the number from the value in register A—but it does not actually change register A. In other words, it figures what the result *would* be—but it does not actually put the answer in register A, as a subtract instruction would.

Maybe you are wondering what good "CP" is—after all, you are not going to get an answer from it. But with a compare instruction, though you never see the result, the processor *does* take notes—it sets the flags, depending on what the answer would have been.

Get the idea? Once the flags are set, we can use a jump instruction that works only if the flags are the way we want them.

For example, suppose register A holds the number 42, and register B *also* contains the number 42. After a "CP B" instruction, since 42 minus 42 would be zero, the zero flag is up.

```
JP Z,location
JR Z,howfar
```

("Location" and "howfar" are just dummies; in a real program you would have to replace them with an actual memory location or distance.)

Suppose registers A and B held two *different* numbers. Then 'A minus B" would *not* be zero. These jump instructions will jump only if the zero flag is *down*:

```
JP NZ,location
JR NZ,howfar
```

These two jump only if the result is *less* than zero:

```
JP C,location
JR C,howfar
```

(The "C" stands for "carry." That is because it is the same flag that goes up when you add two numbers together and the result is larger than a register can hold. It lets you know that you have to "carry" part of the result into another register or memory location. Do not get confused—it is completely different from register C.)

These instructions jump only when the result is greater than or equal to zero:

```
JP NC,location
JR NC,howfar
```

Here are a few examples to show how IF...THEN in Basic can translate into the compare-and-jump sequence:

IF NOT (A=45) THEN GO TO...	CP 45
(or IF A<>45 THEN GO TO....)	JP NZ,location
IF A=7 THEN GO TO...	CP 7
	JP Z,location
IF A<B THEN GO TO...	CP B
	JP C,location
IF A>=C THEN GO TO....	CP C
(or IF NOT (A<C) THEN GO TO...)	JP NC,location

TS1000-ZX81 OWNERS WIN $20,000

ENTER THE ULTIMATE ADVENTURE

SOLVE 12 CLUES LIKE THIS!

Where it all began. Where the torch was first lit. Where muscles and sinews strain. Where our heros win acclaim. Where the symbols hold the key.

KRAKIT™ consists of 12 clues on a ready-to-run ZX81 or TS1000 cassette tape (16k RAM). The answer to each clue is the name of a country, a city or town, and a number. If you are the first qualified entrant to solve all 12 clues and declared the winner, you receive two tickets to the city of the secret KRAKIT™ vault location. When you arrive at that location, a check for a minimum amount of $20,000.00 (U.S.) will be presented to you. The amount of the prize money is augmented weekly.

TS1000 - ZX81

Mail to:
INTERNATIONAL PUBLISHING & SOFTWARE INC.
P.O. BOX 1654, BUFFALO, N.Y. 14216

Please send _____ copies of KRAKIT™ at $19.95 plus $1.50 shipping.

Total _____ enclosed is ☐ check ☐ money order

Charge to ☐ Visa ☐ Mastercard

Number _____

Expiry _____ Signature _____

Please print:

Name _____

Address _____

City _____ State _____

Zip _____

Allow 2 weeks for personal checks.

Take Ten

Has this got you running in circles? Take a short breather. While you do, take a look at the brief machine code routine in Listing 1; it adds up the numbers from 1 to 10. See if you can follow exactly how it does it.

Listing 1.

```
        LD A,1          62,1,
        LD HL,0         33,0,0,
        LD B,0          6,0,
        LD C,A          79,
LOOP:   ADD HL,BC       9,
        ADD A,1         198,1,
        CP 11           254,11
        JR NZ,-8        32,-8,
        LD B,H          68,
        LD C,1          77,
        RET             201
```

You can put this 18-byte routine in memory by using the Basic program in Figure 1. Remember to save some space at the top of memory before you load it in.

First, reserve space at the top of memory like this:

4K ROM:

Type PRINT USR(620). Wait until the screen clears, then type PRINT USR(620) again.

8K ROM:

Run this program:

```
10 POKE 16388,-20
20 POKE 16389,PEEK 16389-1
30 NEW
```

Now, for either ROM, run the following program. Enter the numbers in the right-hand column of the machine code program listing, in exactly the order they appear. If the program is shorter than 18 bytes, fill each extra space by typing zeros.

Figure 1.

```
10 LET Q=17390
20 FOR A=0 TO 17
30 PRINT A; "########";
40 INPUT B
50 POKE A+Q,B
60 PRINT PEEK (A+Q),
70 NEXT A
80 LET B=USR (Q)
90 CLS
100 PRINT B
```

This program is designed for a ZX80 or ZX81 with 1K RAM. For a 2K Timex/Sinclair 1000, change line 10 to read

```
10 LET Q=18414
```

If you are using a 16K RAM module, change it to

```
10 LET Q=32750
```

Multiplication Time

There is no machine code instruction to multiply two numbers on the Z80 microprocessor—the process is just a bit too complicated for its tiny electronic brain. Fortunately, it is not hard to fake multiplication by using addition and a loop.

For example, to multiply 17 by 23 in Basic—without actually multiplying—type in and run this program:

```
10 LET A=17
20 LET B=23
30 LET H=0
40 LET H=H+B
50 LET A=A-1
600 IF NOT (A=0) THEN GO TO 40
70 PRINT H
```

See how it works? Starting with zero in H, you add 23 to it 17 times. The answer, naturally enough, will be 17 times 23.

You can translate this directly into the machine code. The translation is in Listing 2.

Listing 2.

```
        LD A,17         62,17,
        LD BC,23        1,23,0,
        LD HL,0         33,0,0,
LOOP:   ADD HL,BC       9,
        SUB A,1         214,1
        CP 0            254,0,
        JR NZ,-7        32,-7,
        LD B,H          68,
        LD C,L          77,
        RET             201
```

Enter and run this routine using the program in Figure 1. Once you have tried it, you can replace 17 and 23 with other numbers. If you are using the 4K ROM, you will notice that sometimes the result will be negative. That happens when the product is larger than 32767, the highest number your computer can display. To get the correct answer, add 65536 to the negative number.

Optimize!

What is optimizing? It just means making a program more efficient. For example, take another look at the loop in our multiplication program. We can make the routine a little shorter—and a little faster—by using some special Z80 instructions that do not have any equivalents in Basic.

For example, there is the Z80 instruction *increment*, abbreviated "INC." "Increment" means "add one." In other words,

```
INC A
```

is almost exactly the same as

```
ADD A,1
```

(The difference is that "INC" does not send up all the same flags as "ADD.")

The instruction *decrement*, or "DEC" for short, is exactly the opposite; it subtracts one:

```
DEC A
```

is very much like

```
SUB A,1
```

You can increment or decrement any of the regular registers—A, B, C, D, E, H, or L. And instead of taking two bytes of machine code, like "ADD" and "SUB" do, "INC" and "DEC" only take one byte.

But wait, there is more.

All four of these instrucions—"ADD", "SUB", "INC", and "DEC"—will send up the zero flag if the result is zero. That means we can also get rid of the compare instruction that comes before the jump in our multiplication routine.

Here is how it works: each time it goes through the loop, the number in register A drops by 1. when it gets down to zero, the processor sends up the zero flag. We do not actually *have* to test register A with "CP O"—the flag has already been set. Now we can replace three instructions with two—and shorten the routine by three bytes in the process.

The new version of the routine is in Listing 3. Notice that there is a change in the jump instruction, too—now that we have shortened the loop by 3 bytes, the processor only has to jump back 4, instead of the original 7.

Listing 3.

```
        LD A,17         62,17,
        LD BC,23        1,23,0,
        LD HL,0         33,0,0,
LOOP:   ADD HL,BC       9,
        DEC A           61,
        JR NZ,-4        32,-4
        LD B,H          68,
        LD C,L          77,
        RET             201
```

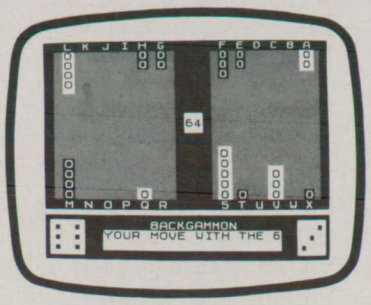
Coming Attractions

...So now we can multiply—which is something much easier to do in Basic. Why multiply using a machine code loop?

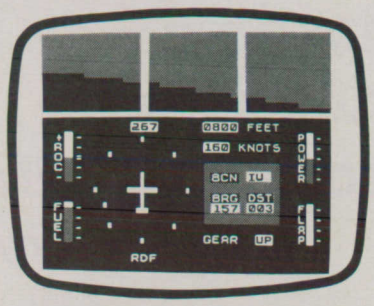
The answer is simple: a loop is a loop. Once you have the hang of using it for something easy, like multiplying, you can start applying it to more interesting problem Next time we will use it to put something on your television screen, and you will see how fast your computer can be—even in "SLOW" mode. When a machine code routine prints something, it leaves Basic behind in a cloud of dust.

If you have comments or questions about machine code programming, or something is not quite clear, let me hear from you. Be sure to send along a stamped, self-addressed envelope if you need a reply.

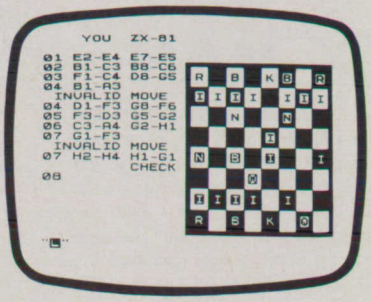
Games that challenge you at a price that won't.



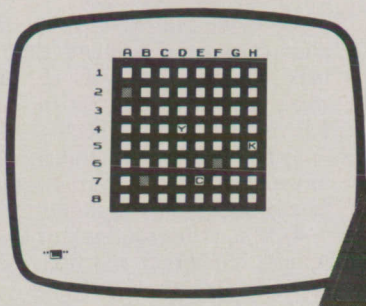
BACKGAMMON

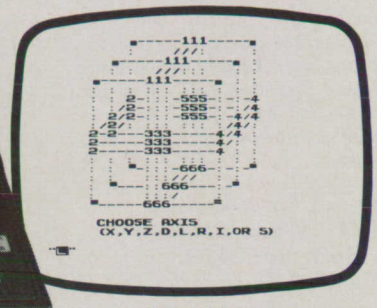


FLIGHT SIMULATOR



CHESS


MIXED GAME BAG



CUBE GAME

$79.95 **Look to Sinclair for the only $79.95 computer and the first Serious Games Package. A special limited time offer. Call toll free today.**

What could be more challenging than creating your own games on a personal computer? Or being intellectually challenged by serious games where you match wits with a computer or another opponent in a fierce trial of skills?

The Timex/Sinclair 1000* is a fully programmable computer with a powerful BASIC language and complete instruction manual, all for only $79.95. The moment you sit down with the TS1000 you can learn how to program your own games. Maybe you want to create a stock market game, a word game, a mathematical game. The challenges are endless.

For this one low price, the TS1000 comes with everything you need for connecting the computer to your color or black-and-white TV.

Of course, you might also want pre-programmed software cassettes for your $79.95 computer. You'll have a wide choice with our free software catalog which comes with the TS1000. And the software cassettes play in any cassette recorder.

The 16K Memory Module. More power to you.

Let's say you want to go one step further. The 16K Memory Module allows you and your family to be challenged by even more sophisticated games. Not mindless arcade games, but serious, intellectually stimulating games which are both fun and educational.

The Memory Module costs only $49.95 and plugs onto the back of the TS1000 for 8 times more memory capacity. A whole new world of software is available to those with the 16K Memory Module.

The Serious Games Package. A $75 value for only $50.

For those who want a lot of serious 16K games, Sinclair announces a special software offering with a $25 savings! Now, for the first time, you can receive all five games shown above at the reduced price of only $50.

Chess: You can play with another opponent or you can match wits with the computer.

Flight Simulator: Maneuver and land a light aircraft with full cockpit controls, instrumentation and navigational aids. You have to allow for wind velocity and direction, rate of descent and mountainous terrain.

Cube Game: Every bit as mind-baffling as Rubik's Cube.

Backgammon: Everyone's favorite. Again, you can play against another opponent or against the computer. Complete with a doubling cube.

Mixed Game Bag: A series of memory and concentration tests including Robot Wars, a version of "Master Mind."

There's never been a better value on a serious games package. And to think it all starts on a $79.95 computer!

Why order today?

In addition to saving $25 on software, there are other reasons to buy your TS1000 today. Computers costing hundreds and even thousands of dollars rarely offer you games this serious or challenging.

Another reason to order today is convenience, by toll-free phone. No crowds, no waiting lines, no parking worries. It's never been easier to get started in the world of computers. Or more worthwhile.

How to order today!

Just call our toll-free number and use your MasterCard or VISA. Or send the coupon with a check or money order. Then try out the Timex/Sinclair 1000 for 10 days at no risk. If you're not entirely satisfied, we will refund your money. It's as easy as that. (Sorry, no refunds on software.)

Call toll-free: 800-543-3000. Ask for operator 509. In Ohio call: 800-582-1364. Ask for operator 509. In Canada call 513-729-4300, operator 509. Have your MasterCard or VISA ready when calling. Phones open 24 hours a day, 7 days a week. These numbers are for *orders only.*

If you simply want information, please don't call, write Sinclair Research, Ltd., 2 Sinclair Plaza, Nashua, NH 03061.

Call toll free 800-543-3000

(operator 509)

Ad code: B3TI

Mail to: Sinclair Research, Ltd.
One Sinclair Plaza, Nashua, NH 03061

☐ Check or Money Order enclosed

	Price**	Qty.	Amount
TS1000	$79.95		
16K Memory Module	$49.95		
16K Cassettes	$15.00 each		
Special Serious Games Package (5 games valued at $75.00)	$50.00		
Shipping/Handling	$ 5.00		$ 5.00
**U.S. Dollars		Total:	

Cassettes for 16K Memory Module: $15.00 each. Check the boxes of all the cassettes you want.

☐ Flight Simulator #6
☐ Chess #7
☐ Backgammon #8
☐ Cube Game #9
☐ Mixed Game Bag #26
☐ I'll take all 5 cassettes included in Sinclair's Special Serious Games Package.

Name

Street

City

State Zip

*Sinclair technology is the heart of both the ZX81 and the Timex/Sinclair 1000 computer.

sinclair

ATTO-SOFT

PRESENTS

ZX-MAN

ZX-MAN. Turn your **ZX81** or **TIMEX SINCLAIR 1000** into an arcade type game computer with **ZX-MAN.** 100% machine code makes this fast acting program as much fun as being at the arcades. With the joystick option you can have the real feel of game playing never before available for your **ZX81** or **TIMEX SINCLAIR 1000. 16K required..... $14.95**

JOYSTICK. With **ATTO-SOFT's JOY-STICK** your **ZX81** or **TIMEX 1000** can be turned into an arcade type computer allowing fast control over **ZX-MAN** and other type software. Requiring only six simple solder connections inside your computer. Also included is software to develop your own programs..... **$14.95**

Special Thru April 30
JOYSTICK and ZX-MAN
Both for $24.95.

(Please add $ 1.50 Postage and Handling. COD's add $ 2.00)
Send check or money order to:

ATTO-SOFT
832 E. Third Street
Galesburg, Illinois 61401
(309) 343-4114

STARTER PACKAGE
ZX/TS (1K)
This is a group of 14 programs to introduce the langauge basic. These programs cover several topics (games, education & graphics) only $14.

Troiano Software Company
P.O. Box 40
Nesconset, New York 11767

Only $10
Grizzly FLIGHT SIMULATION
and AIRLINE MANAGEMENT Game
Free Animated Graphics
Course with each order!
Hensley & Associates
Box 334 Asheboro, NC 27203

Custom Computer Carrying/ Storage Cases
High impact plastic, foam padded.
Holds computer, memory, cables, and recorder. $49.95
Sights & Sounds Systems
P.O. Box 29177
Richmond VA 23229

PRACTICAL HELP FOR TEACHERS IN GRADING TESTS. A VARIETY OF PROGRAMS DEVELOPED AND USED BY A TEACHER NOW AVAILABLE IN 1K, 2K, AND 16K RAM FOR USERS OF ZX81/TS1000 COMPUTERS. SEND $1 AND SASE TO ADDRESS BELOW FOR SIMPLE BUT EFFICIENT 1K QUIZ GRADER AND CATALOGUE:
DIANA ROWLAND,
97 ESSEX AVE.,
MONTCLAIR, N.J. 07042

8K ROM

Machine Language Storage in REM

Jasper Kump

If you need to provide storage space for even a moderately long machine lansuage program, filling a REM statement with exactly the right number of dummy characters can be quite a chore, and making space for a really long problem is sheer drudgery. There is a way that you can provide as many spaces as you like without having to type even 100 dummy characters.

As I am sure you know, the EDIT function can be used to duplicate an existing line. It would seem that this could be used to create as much storage space as required, and it can.

However, there is more to it than just duplicating lines. Since the ZX81 does not store lines exactly as you enter them, this complicates matters a little. The decimal line number is converted and stored as a two byte hexadecimal number. All commands within a statement are stored as a single hexadecimal code byte. Two more bytes are used to store the byte count of the line, starting at the first code byte and including the decimal number 118 with which each line is terminated.

When a series of consecutive REM statements is to be used to provide storage for machine language the leading four bytes of the second and subsequent REMs cannot simply be overwritten. Your machine language program would almost certainly crash.

The solution is relatively simple. Change the byte count of the first REM statement to include the byte count of all of the REM statements to be used for machine language storage. This count must include not only the dummy characters in each REM, but also the other bytes the ROM uses in storing the line. Two for the line number, two for the byte count, one for the command code byte and one for the terminator for a total of six.

Therefore, if you wanted to reserve 500 spaces, it would seem logical to assume that five REMs, each containing 94 dummy characters would do the job. Let's see if it will.

Jasper Kump, PO Box 108, Pyatt, AR 72672.

In the first REM only the terminator will be converted to a storage space. That's 95 spaces. All 100 bytes of the second, third, and fourth REMs will become storage space, but only 99 of the fifth because the terminator must remain. This makes a total of 494 storage spaces, six short. Five REMs of 95 characters will still be one short. EDIT can be used to add one more character to one of the REMs.

You can find the number of REM statements and the number of dummy characters that should be in each one in the following manner:

1) Add six to the number of storage locations that you need.

2) Divide the result by the number of characters you estimate that you will need in each plus six. If there is no remainder, the result is the number of REMs that you will need.

3) If there is a remainder, and, if it is more than the integer, increase or decrease the number of dummy characters.

4) When the remainder is less than the integer, construct the first REM statement on line number 1 and duplicate it the required number of times. Then add the remainder, if any, to one of the lines using EDIT.

5) To check everything up to this point, add 16514 to the number of storage locations that you intend to create and PEEK the resulting locations that you intend to create and PEEK the resulting address. You should find 118 there which is the terminator of the last REM statement in decimal form.

6) Now add 2 to the number of storage locations you want and divide the result by 256. POKE the remainder, even if it is zero, into 16511 and the integer into 16512, the locations of the byte count.

The first time you use this system, you will probably think it did not work because, when the Basic program is listed, the REMs that were supposed to be eliminated will still be listed. Before you spend a lot of time and effort checking for errors and then writing a letter to the editor if you cannot find any, try this. Use the up and down arrows to move the cursor. You should find that it skips from line 1 to the line following the last REM listed or, if there is no such line, the cursor should stay on line 1. If the cursor does not do this, *then* start looking for errors.

This system can also be used to add more space for machine language programs if you should need it. In this case it becomes very simple. Just add the total number of bytes in all of the REMs that you add. Although the terminator of the last new REM cannot be converted to storage, the terminator of the existing REM will be, so everything comes out even.

Make Your Sinclair Work Harder, Better...

with quality, affordable and dependable peripherals from CAI.

The Interface

The CAI/O Board® plugs into the computer's expansion port and is the interface that lets your computer communicate with the outside world.

There is a serial RS-232 compatible I/O port, 3 parallel I/O ports used to design circuits to control home lights, power relays and additional ports to accept printer, mass storage device and memory expansion.

$79.95 when purchased separately

$69.95 when purchased with CAI peripherals

The Printer

New! The CAI/P40 prints the complete library of regular and inverse alpha-numerics and graphics in 40-column width. Three user-addressable modes print in regular or enhanced (double type size): List program from memory, print text or data from program, print screen

$139.95 complete stand alone printer. (can be upgraded to use with other CAI peripherals)

$119.95 requires CAI/0 Board for complete compatibility with other CAI peripherals

Mass Storage Device

CAI introduces the Stringy Floppy® for the Sinclair or Timex Sinclair. It has the speed of a disc drive at a fraction of the price. Data is stored on an inexpensive continuous loop magnetic tape cassette. This device inputs and outputs data at an incredible 14,000 baud - - 56 times faster than Sinclair cassette recorder interface.

The system is designed to accommodate two Stringy Floppy drives for even more versatility.

$109.95 per drive
Requires CAI/O Board

Computer Network Package

This package consists of ASCII conversion program, phone modem, connecting cable. Now you can communicate with large main frame computers, micro-and mini-computers and computer networking systems (The Source®).

$149.95 Note: Order this package when ordering your CAI/O Board.

$24.95 for ASCII conversion program only

Additional Peripherals

Memopak® 64K memory expansion
$159.95

Programs:

$14.95 Home Finance

$9.95 Math Tutorial

$9.95 Stocks

$9.95 Wiz Bang Math

$7.95 Bio Rhythms

Why buy from CAI?

All CAI peripherals come with complete instruction manuals, schematics and a 30-day unconditional replacement warranty. Each works with either the Sinclair ZX-80, ZX-81, MicroAce and Timex/Sinclair 1000.

Our technicians are happy to answer your questions before and after purchase.

CAI Instruments, Inc.
P.O. Box 2032
Midland, MI 48640

Phone: (517) 687-7343 Office Hours: 9:00 a.m. — 4:30 p.m
Evening Hours (Technical Information) 6:00 p.m. — 8:30 p.m

Orders accepted by phone or mail. For mail orders, send check, money order, VISA or MASTERCARD numbers. Foreign orders must be made in U.S. currency.

Quantity	Description	Unit Price	Total
	CAI/O Board	(See Price)	
	CAI Printer	(See Price)	
	Stringy Floppy	$109.95	
	Other		
SUBTOTAL			
	Shipping and Handling		
	4% Sales Tax (Michigan Resident Only)		
	TOTAL		

☐ Literature, enclose $1.00
SHIPPING AND HANDLING CHARGES
Within U.S. $5.00 Outside U.S. — F.O.B. Midland, MI

MasterCard/Visa _____
Exp. Date _____
Name _____
Address _____
City _____ State _____ Zip _____
Phone No. _____

FOR ZX-81/TIMEX 1000

LOADING AID

Removes guesswork from adjusting volume. Plugs in between computer and tape recorder. Red & green LEDs on — Optimum Volume Set. Red LED (only) on — volume too low. Yellow LED on — Volume too high.

$25 incl. instructions

Push button to reset 'K' Cursor **$2 extra**
Earphone & SKT to monitor 'Voice Overs' **$3 extra**

KEYBOARD BLEEPER

Provides feedback missing from touch sensitive keyboard cheaply — easy installation. All 210 characters bleep in slow & fast modes. No soldering required — all connections plug-in.
Fits inside case either under keyboard or PCB. No trailing wires — also suits most full size keyboards.

$21 incl. illustrated instructions

On/Off Switch **$3 extra**

T-SHIRTS $8 SWEATSHIRTS $17

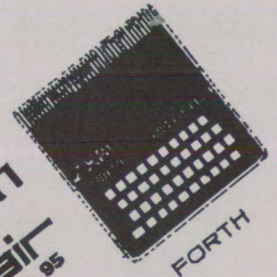
Black with Red "SINCLAIR ZX81"

Terrific hand airbrushed multicoloured designs. "I'm a Micro Addict" or "Micro Computers Take You Into Another World", against space scene.

T/S $10 S/S $20

Specify size required — 24" — 44"

FULCRUM PRODUCTS
14 STEEP LANE
FINDON, W. SUSSEX, BN14 OUF ENGLAND



multi forth for the sinclair $49.95

- compiler version (standard FORTH is interpretive)
- up to 130 times as fast as ZX81 BASIC™
- 8KB EPROM (2764) replaces BASIC ROM
- multi-tasking
- built in editor
- split screen
- cassette I/O routines resident in EPROM
- (system must have 2KB RAM)

Trade mark of sinclair research Ltd.
(information available)

free systems
of grand rapids
233 3645 26th Street
Suite Grand Rapids, MI 49508
Phone: 616 949 8506

© 1983

System Expansion Hardware

Robert B. Trelease

System Enclosures and Radio Frequency Interference

In a previous article (*SYNC* 2:3) we considered a standard keyboard conversion for the MicroAce and Sinclair ZX80/1 computers as a foundation for expansion-oriented systems. Because a keyboard array usually requires an enclosure and the VHF modulator-based display of "American" systems is susceptable to machine-generated radio frequency (RF) interference, a metal enclosure was considered a valuable addition. CPU/system generated RF interference can reach the television via the power line (inadequate power supply filtering) and via direct radiation (inadequate computer or peripheral shielding).

Although one can bypass RF emission problems by directly driving a composite video monitor or by replacing the VHF modulator with a "European-type" UHF unit, good engineering practices and the FCC suggest shielding the system. For settings which require minimized RF emission (e.g., the brain research laboratory in which I work) good practice definitely rules. My mail, some of which has complained about poor video display quality with unshielded, plastic keyboard enclosure kits, indicates that functional RF shielding is probably a necessity for other serious users as well. With a metal enclosure, one does not need to connect added "ground planes" to system 0 volts—the entire chassis becomes a grounded shield.

Because I had a ZX81, I decided to mount my ZX80 "semi-permanently" inside a large aluminium keyboard enclosure (BUD type KB 13202). Some salvaged plastic printed circuit card guides were trimmed and glued to the inside of the enclosure cover, and the bare Sinclair board could fit snugly inside its new housing. A slot was cut in the back of the new enclosure to allow access to the bus edge connector. A small utility box was attached by screws to the back of the main housing, and mini-phone plug extensions were made for power and tape connections.

The enclosure was 'grounded' (connected to system 0 volts) at the shield of extension cable from the 9 volt connector on the computer. Inadvertent contact with system ground was avoided by coating external bare metal surfaces with epoxy paint. The enclosure layout left plenty of room inside for future additions, such as a heavy duty power supply, batteries, or additional circuitry. This particular enclosure was also large enough to accommodate a "fully dressed" ZX81, and a mounting bracket could make use of the Sinclair-designed screw holes for accessories on the plastic chassis. The use of the connector box and phone-plug extensions made it possible to add a power switch and indicator, as well as an additional connector for direct video.

Robert B. Trelease, Jr., 2313 5th St., Santa Monica, CA 90405.

The original sense of the conversion was retained because the computer can be rapidly and easily returned to its original case. The keyboard conversion as a unit also became a foundation (less portable!) for expansion of the Sinclair system with emphasis on typing/input convenience and "laboratory grade" peripheral modules. The rest of this article considers two approaches to modules which could be used in such expansion.

Experimenter's Prototype Module

At this point, I will admit another prejudice—ever since the first 8080 CPU systems were introduced, I have wanted to own a microcomputer "development system." Over the years, various manufacturers have marketed many different systems configured for experimenting with and designing peripheral hardware. For the most part, however, such systems have been relatively more expensive and "less friendly" than the simultaneously evolving personal computers. The serious computer hobbyist or dedicated "hacker" thus had

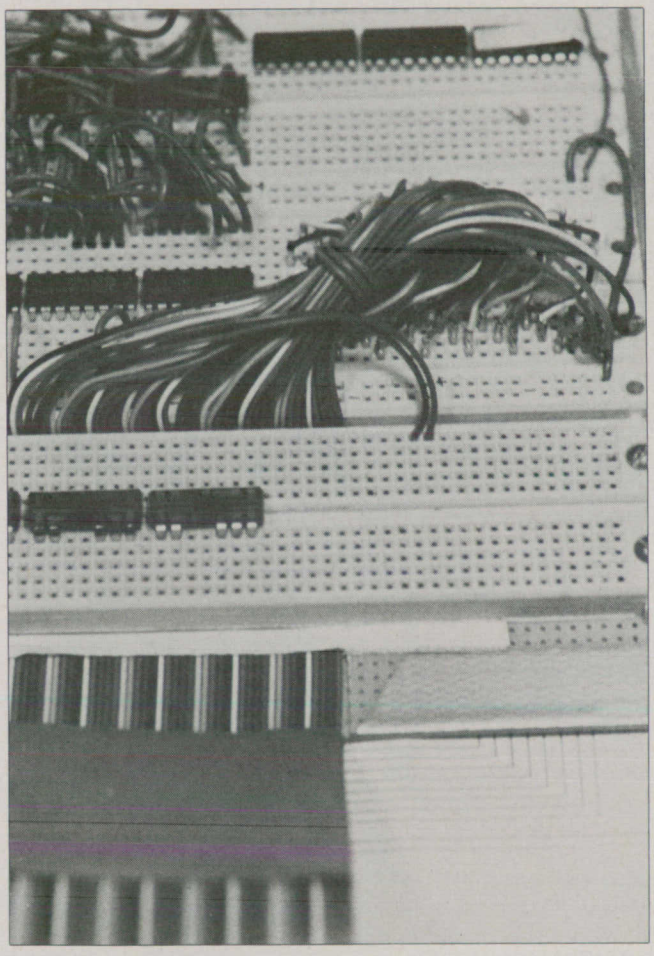


Figure 1. Closeup of prototype connectors showing insertion of ICs, jumper wires, and ribbon cable leads. In this picture all bus lines are inserted in terminal holes in a restricted area of the prototype connector.

to buy a costly commercial development system or had to overcome hardware and software limitations of using a "home computer." When Sinclair introduced the ZX80 and ZX81, it became apparent that they could be used as inexpensive components in such development systems, while retaining their stand-alone capability and "user-friendly" characteristics. Very nearly the "minimum system" described in the *Ziloq Z80A Technical Manual*, the ZX81 has the particular advantages of: 1) an operating system and Basic which support printer and input/output (I/O) opera-

CLEVA computer ware

ZX81 TS1000

ENTERTAINMENT PROGRAMS

SNAKEBITE	Eat the snake before it eats you.
BATTLE	Demanding game of military strategy that can be played by 1 to 4 players.
STARSHIP TROJAN	Pit your wits against the dangers of outer-space and try to save your damaged space-craft.
PRINCESS OF KRAAL	Face the monsters hiding in the underground and save the Princess.
STARTRACK	Use photon torpedos to kill off the Klingons.
FUNGALOIDS	Save civilization by bombing the ever-multiplying fungus.
CRAZY-CARDS	Totally addictive for cheats.
CUBE	Use your computer to solve the mysteries of the Rubik Cube.

TWO GAMES FOR THE PRICE OF ONE (ONLY $12.95)
All programs 16K

MACHINE LANGUAGE PROGRAMS

ASSEMBLER $16.95
2 pass assembler written especially for the ZX81/TS 1000 (16K). It is simply the best assembler available for those who wish to write their own machine code programs. It is designed to run alone, or together with the dis-assembler, and/or the de-bugging program. These provide a system for writing, editing, checking and testing machine code programs that is second to none.

DIS-ASSEMBLER $16.95
Allows you to read the ZX81/TS 1000 ROM (16K) with the best dis-assembler program available. It is written specifically for Sinclair/Timex computers, and unlike some programs modified from Intel 8080 dis-assemblers it gives full Z80 Mnemonics.

DE-BUGGER $16.95
Makes writing machine code programs easier. Works entirely in decimal. Therefore hexadecimal is not needed. (16K)

PROGSTORE/TOOL-KIT $16.95
Progstore contains a series of machine-code routines that create 3072 bytes of user space and then transfer into this space machine-code routines that allow the transfer of a BASIC program into the user space after running this program allow a return to another BASIC program stored conventionally in low memory.

TOOL-KIT
Progstore toolkit contains four "utility" programs specially written to operate from progstore. Having loaded progstore in Toolkit can be loaded and then progstored with RAND USR 32500. Each program can be run by RAND USR 32723.

HEXLOADER—This program allows machine code programs to be rapidly written in hexadecimal.

HEXLISTER—This program complements HEXLOADER by allowing machine code programs to be listed in hexadecimal.

PROGMERGE $16.95
Progmerge contains a series of machine-code routines which allow BASIC programs to be stored whole or in part.

Please send check or money order. NO CASH!
New York Residents only add 8¼% Sales Tax.
SHIPPING AND HANDLING
Add $1.50 for first item and $.50 cents for each additional item.
Name_____
Address_____
City_____ State_____ Zip_____
Mail To: CLEVA Computer Ware
P.O. Box 2736
Brooklyn, N.Y. 11202 (212) 875-1207

PREMIUM CASSETTES

COMPUTER GRADE
100% ERROR-FREE
FULLY GUARANTEED

MANUFACTURER PRICES

The Micro-Trac™ Generation

- High Frequency Response
- Wide Dynamic Range
- *Used by Software Firms & Computer Hobbyists*
- Choice of School Districts Nationwide

LENGTH	12-PAK	24-PAK
C-05	$ .69	$ .59
C-10	$ .79	$ .69
C-20	$ .99	$ .89
C-30	$1.19	$1.09
C-60	$1.49	$1.39
C-90	$1.79	$1.69
*CASES	$ .21	$ .20

*Cases recommended to protect sensitive cassettes.

—UPS SHIPPING—
(No P.O. Boxes please)
$2.00 (12-pak) $3.00 (24-pak)
—Canadian shipping multiply by 2—

#1 COMPUTER TAPE IN THE USA!

—write for volume prices—

TOLL-FREE
(orders only)
1-800-528-6050
ext. 3005
In Arizona
1-800-352-0458
ext. 3005

VISA

master charge

MICRO-80 ™ INC.

2665 Buzby Road
Oak Harbor, WA 98277
—Distributors Wanted—

tions; 2) an expansion bus which provides access to all Z80A pin signals; 3) the ability to call machine code routines from Basic; and 4) the fundamental capacity of the Z80A for both controller and mathematical/logical computation operations.

Given the apparent suitability of the ZX80/1, I set out to produce a peripheral which allows the rapid design and development of new hardware. For the electronics experimenter, nothing currently beats 0.1″ dual in-line package (DIP) spacing "proto-board" connectors for speeding assembly of functional circuits, and Figure 3 shows an experimenter's prototype module based on these components.

I chose some Continental Specialty QT-59S and QT-59B connectors, 1 ′ of standard 50 conductor "rainbow" ribbon cable, a 50 pin Winchester 0.1″ dual readout PCB edge connector, and some Amphenol 220-P02-100 male miniature connector pins. Other commonly available edge or "proto-board" connectors could have been used. The PCB edge connector was simply cut to 46 pin length, keyed, then press-fitted to one end of the ribbon cable. Individual wires at the other end of the cable were separated, stripped, and terminated with the Amphenol pines (soldered). Continuity and lack of shorts were confirmed for all wires between the pins and the PCB connector.

In order to identify the signal associated with each ribbon cable lead, wire markers were made. A list of ZX bus signals was typed on a sheet of paper, and each signal name was cut out and attached like a flag to the appropriate wire using clear cellophane tape. A wire bracket was glued to the back of the PBC connector to aid in insertion and removal.

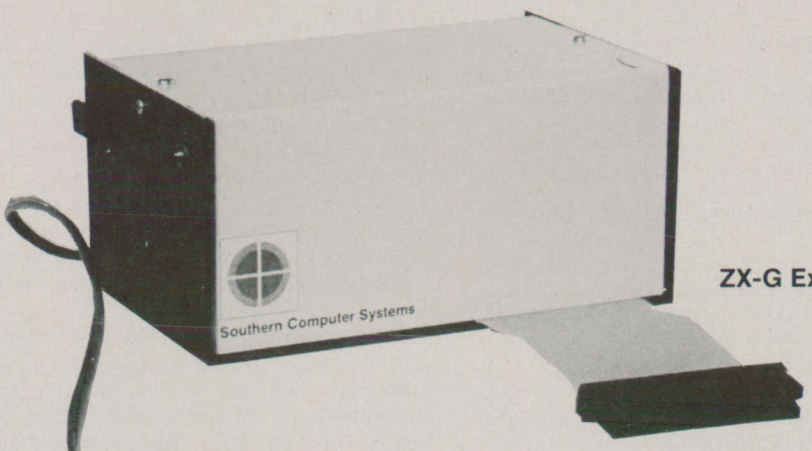
The protoboard connectors were mounted on a piece of phenolic circuit board, and the pin end of the ribbon cable was passed between two of the connector strips, as shown in Figure 1. The phenolic board served as a spacer between the connectors and the enclosure in which the assembly was mounted. The L.M.B. OH-743 aluminum cabinet was large enough (7″ x 6″ x 2 3/4″) to enclose the proto-board assembly while allowing external panel space for mounting I/O connectors, switches, indicators, and potentiometers needed for circuit construction. A slot was cut in the side of the cabinet to allow passage of the ribbon cable. For reducing radio frequency interference, a ground (zero volt) lead from the bus was connected to the cabinet. To avoid inadvertent contact with system ground, exposed metal surfaces were coated with epoxy paint.

Using such a protoboard, one can rapidly construct circuits such as the Z80 PIO described by Alger Salt (*SYNC* 1:4), analog to digital converters, and other devices useful for communicating with the "real world."

Particularly attractive LSI chips for such experiments include the Zilog Z80 counter/timer (CTC), direct memory address (DMA), and the serial I/O (SIO) circuits, as well as the 82xx series of microprocessor components made by Intel and others.

Power for the experimental circuits can be drawn directly from the 9 and 5 volt bus lines. However, care must be taken not to load down the ZX power supply or regulator. Furthermore, since ZX bus lines are unbuffered, special care must also be taken not to load or to short the other signals. If the device being constructed does not connect too many ICs to each line and the connecting cable is short, little trouble may be experienced. However, the best practice is to buffer the control, data, and address lines. This can be done on the proto-board with 74LS244 or 81LS95 octal tristate noninverting drivers for unidirectional bus signals (e.g., A0-A16) and 74LS245 octal tristate noninverting bus trans-

Sinclair Hi-Res Graphics + 48K RAM + 8K EPROM Programmer



ZX-G Expansion Unit

Plug into Extended Use

Timex/Sinclair 1000****

Cassettes

T601	BUDGET MASTER 1000**	15.95	T607	Cosmic Invaders	14.05
T602	2K Programmer Kit**	12.95	T608	Sabotage	14.95
T603	Reversi 1000**	15.95	T609	ZX Scramble	14.95
T604	2K TREK**	15.95	C310	2K Fun Pak (Music Maker, Breakout, (Invaders)	14.95
T605	3D MAZE	15.95	C311	Gulper	15.95
T606	ASTRO 1000	14.95			

Introducing Hi-Resolution Graphics for the Sinclair ZX-81

Now you can create detailed graphics images with the new, high quality, low cost **ZX-G Expansion Unit.**

Quality Graphics

The ZX-G gives your ZX-81 the ability to create memory-mapped graphics images with a resolution of 256 X 192 pixels.

— Graphics images can be drawn, moved, rotated, mixed with text, saved on cassette or printed.
— Excellent for Computer Aided Design, education and games.

Powerful Software! (cassette included)

— Generate lines, circles, and rectangles with ease!
— A dynamic graphics cursor facilitates rapid design.
— Graphics animation is fully supported!

Memory Expansion!

— With the ZX-G, you can expand the memory of your computer to 48K!
— Up to four hi-res. graphics screens can be stored in addition to a 16K program!

EPROM Programmer Support!

— With our optional EPROM programmer, (fully transparent), 2716 (8K) EPROMs can be programmed, verified and run directly in memory map (2000-3FFFH)

Compact Design!

— The total unit (including power supply) is enclosed in an attractive vinyl-clad aluminum case.
— Cable and power cord included!
— 90 Day Warranty (parts & labor)

ZX-G Expansion Unit **$99.95**

RAM/EPROM Option **$79.95**
(includes 32K RAM + four 2716 EPROMs, ZX-G required)

Free Graphics Software

Mail Order to:

Southern Computer Systems
630 Main Street
Shelbyville, Kentucky 40065
or call collect: (502) 633-5640

NOW QUALITY 16K CASSETTE SOFTWARE AMAZING LOW PRICE!

SIMPLEX SOFTWARE INTRODUCES THE HOME-PAC™
20 programs ready-to-run
ONLY $19.95 postpaid

$1 EACH

Now for under $20, you can get a complete collection of 20 quality, user friendly and reliable programs for the 16K TIMEX or Sinclair ZX81 computers. Although easy enough for beginners to use, even computer experts will find these programs useful. In fact, as useful as other programs costing several times more.

SOFTWARE TO UNLOCK THE POWER OF YOUR COMPUTER

We've developed programs that you want and need. Useful programs to assist you in home budgeting, education and many other tasks. We've also included recreational and utility programs to help you unlock the power of your computer. Included are:

- BIORHYTHMS
- KALEIDOSCREEN™
- CHECKBOOK BALANCER
- ANIMALS
- BASIC STATISTICS
- VECTOR MATH
- RENUMBER
- COMPU-SKETCH™
- ORGAN MUSIC
- NET PRESENT VALUES
- MATH DRILLS
- SIMULTANEOUS EQ'NS
- MACHINE LANG. MONITOR
- ANY MANY MORE

ADVANCED SOFTWARE DESIGN

Programs are written in BASIC and/or machine language and incorporate software and human factors engineering usually found only on much more expensive software packages. They are supplied on a high quality cassette tape which is **GUARANTEED** to load and run. And the programs are listable, enabling you to modify and customize them to your requirements.

FREE USER'S BOOKLET

The HOME-PAC™ comes complete with a booklet explaining, step-by-step, how to run the programs. Also included is a section with tips on customizing and modifying many of the programs.

ORDER YOURS TODAY! ONLY $19.95!

To order, use the coupon below, or for VISA/MC only call 201-545-0990

SIMPLEX SOFTWARE
Dept. A2, P.O. Box 792
New Brunswick, N.J. 08903

Please send me the HOME-PAC, 20 cassette programs for my 16K ZX81 or TIMEX 1000. All for only $19.95 postpaid. (N.J. residents add $1.20 sales tax, foreign orders add $2.00 shipping).

Name: _____

Address: _____

City, State, Zip: _____

☐ **Check or M.O.** **Charge to # VISA** ☐ **MC**

Card #: _____ **Exp. Date:** _____

Signature: _____

OFFER GOOD FOR LIMITED TIME ONLY!

DEALER INQUIRIES INVITED

ceivers for bidirectional signals. As an alternative, the prototype module can be used with a buffered bus expansion. (See Figure 3.)

Computer Continuum Buffered Bus Expansion Board

There are now many bus "expanders" available commercially for the ZX80/1, Timex/Sinclair, and MicroAce computers. One can adapt the Sinclair bus to drive S-100 or STD bus compatible devices, or one may opt to use the many accessories configured for the ZX80/1 bus connector. The latter approach has some special merit, because many peripheral manufacturers are following the Sinclair lead in producing simple, inexpensive devices. Perhaps the earliest buffered "mother-board" of this latter type was offered in the U.S.A. by Computer Continuum of San Francisco. In addition to the ZX80/1-type bus connectors, however, the Computer Continuum board has four additional connectors which allow one to use many of the standard perforated prototype board commonly available in stores such as Radio Shack.

The expansion board may be obtained from Computer Continuum as either a bare, printed circuit board or a "complete kit" including sockets and integrated circuits—minus an enclosure. The board is of extremely high quality, with plated-through holes and a durable solder mask. Builders who soldered their own Sinclairs will find the Computer Continuum board extremely easy to work with, due to the uncramped part spacing.

As shown in Figure 2, a nearly complete expansion board has a female, 44 contact, 0.1″ spacing connector for mating with the ZX80/1 card edge, buffering and bus control circuitry, a 5 volt power supply regulator, four standard 44 pin 0.156″ spacing dual readout PC edge connectors, and two spaces/connectors for 50 (48) pin 0.1″ ZX80/1-style connectors or cable headers. The board is set up for a 5 volt 3 amp LM 323K regulator, and it only requires a 9 volt rec-

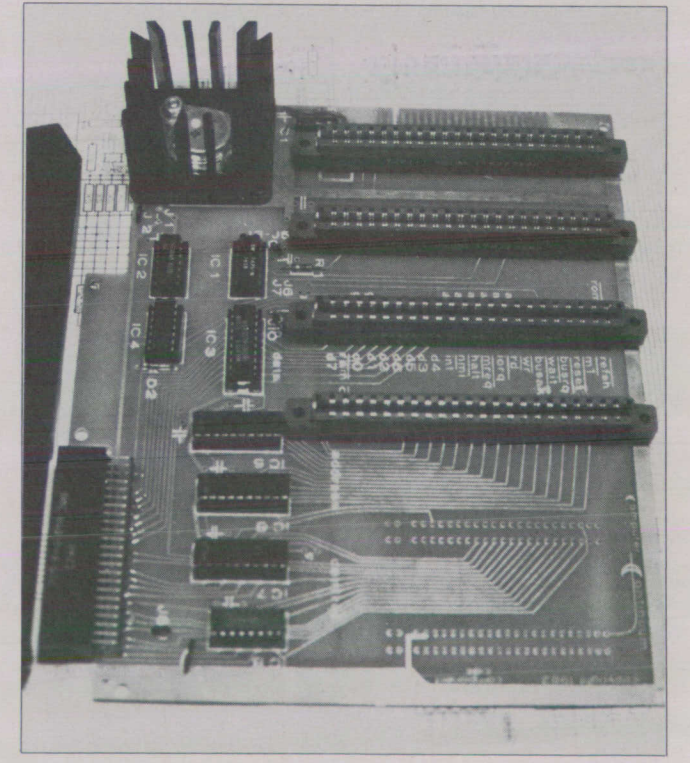


Figure 2. Computer Continuum expansion board shown at connection to ZX81. No PC board mounting flange.

tified source to provide power for the expansion hardware and the computer. The expansion board contains many jumper-selected options (good show!) to allow such things as

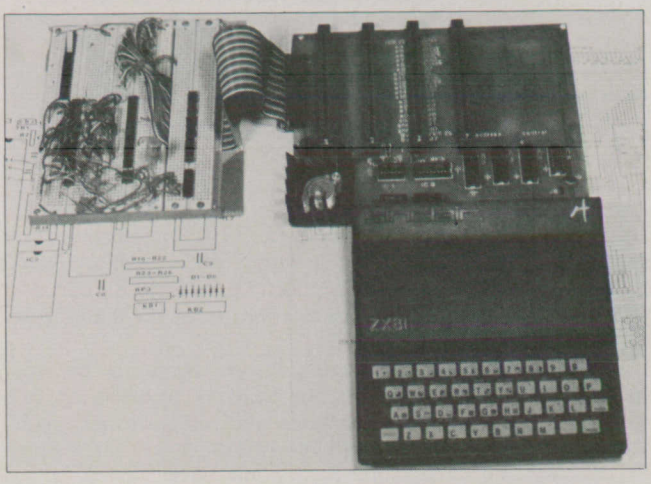


Figure 3. Bare prototype module attached to expansion board "Sinclair-type" connector edge. This configuration allows prototype module circuitry to be driven by buffered bus lines.

using the 9 volt Sinclair power supply, I/O addressing, and bus disabling. The four 0.156″ connectors allow the serious experimenter to use durable prototypes built with readily available wire-wrap or solder-pad experimenter's boards, while the board also has one connector/edge for "standard" peripherals like the ZX 16K memory. All connectors are buffered, preventing ZX bus loading. An earlier version of this expansion board had the 0.1″ connector solder pads "flipped" left-to-right, inverting the order of the signals as they would normally appear on the ZX80/1 bus edge connectors and requiring some "reverse Polish engineering" to obtain connector compatibility with manufactured peripherals. The current version of the board has "right" 0.1″ connector pad configuration and additional options available for I/O addressing logic.

As a whole, I found the Computer Continuum expansion board to be a beautifully executed kit allowing relatively inexpensive yet flexible expansion of the ZX80/1 bus capacity.

Hardware Logic: Permutations and Combinations

SYNC readers can probably come up with many different ways to put together all these system pieces. Focusing on the bus expansion board, several permutations are possible. The Computer Continuum Expansion Board has a flange which allows it to be firmly fixed to a standard ZX81 or T/S 1000 using machine screws threaded into the Sinclair chassis accessory screw holes. Alternatively, a bare ZX81 card may be vertically mounted on the expansion board with the use of a straight-pin 0.1″ connector. In either case, the manufacturer has assumed that the expansion board is not housed in an enclosure.

As discussed above, this can create great video display problems for a system employing a VHF modulator. Computer Continuum currently deals with this issue by recommending that one substitute a UHF modulator or shield the television's tuner stage. As suggested above, a complementary procedure might be to mount the expansion board in a large aluminum chassis box. This solution sacrifices some flexibility, however, placing some physical limits on the size of PC cards one could use in the accessory slots.

A simpler approach is to construct two aluminum ground plane covers for the top and bottom of the expansion board. The covers can be attached using the screw holes provided on the PCB and connectors. The profile of the expansion board module is kept low, and each peripheral card could be supplied with its own ground plane shielding. With this scheme, one could make use of the mounting flange for a standard ZX81 or T/S 1000.

Connections from the keyboard conversion unit to the expansion board module can be made with a ribbon cable using 0.1″ dual readout male and female connectors (available through Computer Continuum and other sources). The prototyping module and other peripherals could then be attached to the expansion module connector edge. Note that use of an unshielded ribbon cable adds a source of RF emission to the system.

Using the prototype module in conjunction with the expansion board described there has several advantages. THe greatest asset is to be able to build a circuit rapidly on the prototype connectors and then to transfer this circuit to a "hard-wired" soldered or wire wrapped card which can be plugged into the 0.156″ connectors.

In following articles, we will consider the construction of other modules using this system, with the intent of building components for use in educational or laboratory settings. In particular, we will focus on time/frequency and voltage measurements and use of FORTH as a language for control and analysis. ■

PREMIUM DATA CASSETTES

MANUFACTURERS WHOLESALE PRICES

LENGTH	10-PACK	100-PACK	500-PACK
C-10	.59EA.	.54 EA.	.45 EA.
C-20	.66	.61	.53
C-60	.89	.83	.79
C-90	$1.29	$1.21	$1.14

SOFTWARE PUBLISHERS —LET ACTS AUDIO PROVIDE YOU WITH ALL YOUR CASSETTE PRODUCTION REQUIREMENTS.

CUSTOM SOFTWARE DUPLICATION — FOR SINCLAIR, TRS-80, APPLE, ATARI — GUARANTEED TO LOAD.

ACTS AUDIO ALSO SELLS HIGH-SPEED DUPLICATION EQUIPMENT MODIFIED FOR SOFTWARE DUPLICATION.

ACTS AUDIO, INC.
70 WEST ILLIANA AVE.,
ORLANDO, FL. 32806
(305) 423-0338

Pay by check, Mastercharge or Visa. Add $5 for C.O.D. shipments. Florida residents add 5% sales tax. No shipping to P.O. Boxes. Shipping by U.P.S. to continental USA only. For shipping and handling add $2 for 10 pack, $5 for 100 pack, $12 for 500 pack.

A Regulated-Voltage Power Adaptor

Robert D. Hartung

If low power-supply voltage is indicated (under 9 volts with load) or you wish to add peripherals such as a RAM pack and printer, a 9 VDC regulating-adapter may easily be made up for use with a CB-radio power supply (or for portable use in your car, boat, or plane if you have an AC/DC TV to use with your ZX computer). Also, if you are interested in both computing and SSB radio, your receiver may be used as a key-stroke monitor.

Robert Hartung, PO Box 125, Palmyra, NY 14522.

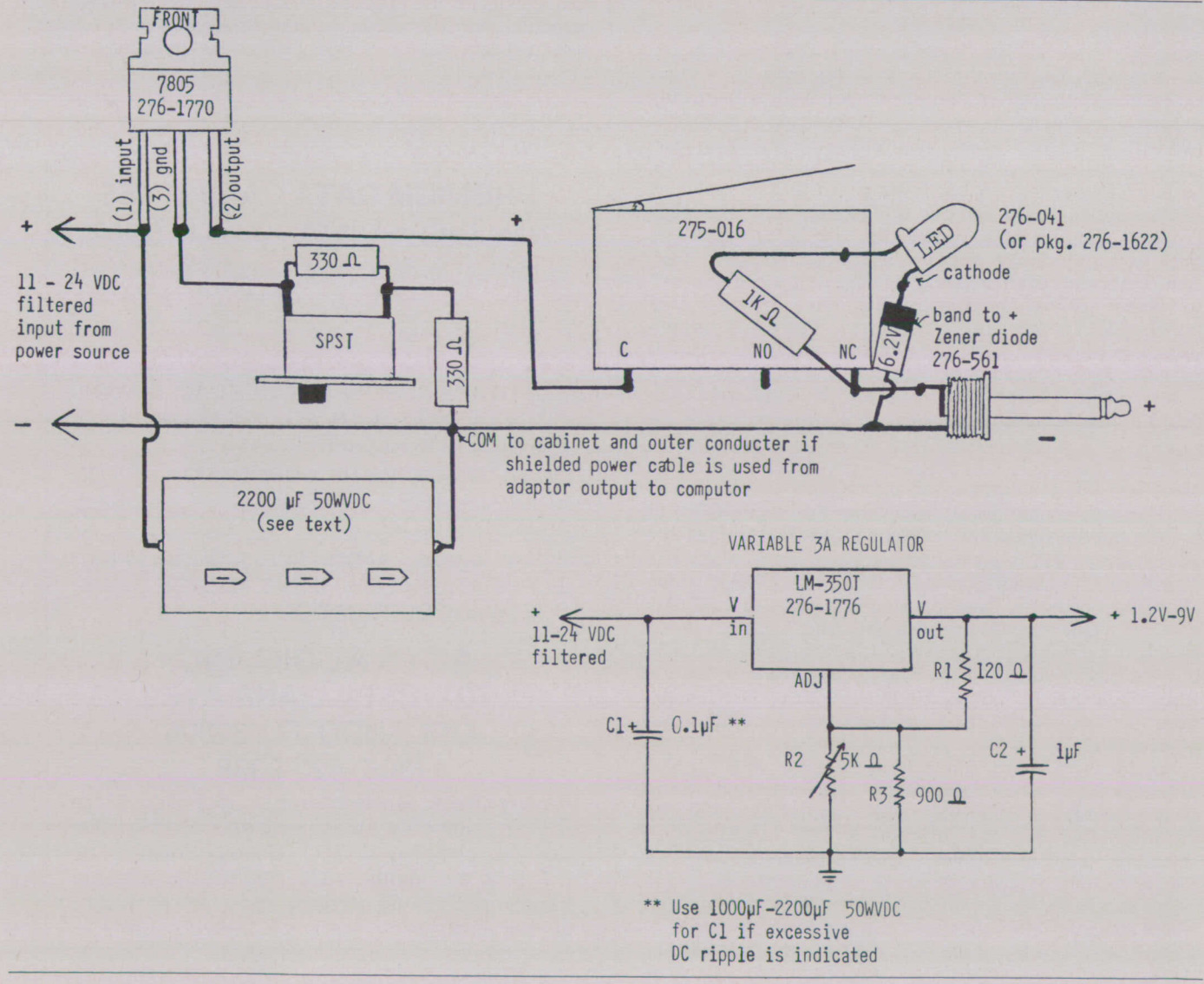
The RFI from the computer will produce audible tones when you press the computer keys as well as during the running of routines. Do not transmit during a SAVE or a LOAD, however, as the RFI from the radio works the other way also.

A 7805-type regulator (Radio Shack 276-1770) is rated for 1 amp. output, which is ample for the computer with a RAM pack. The LM 350T-type regulator (RS 276-1776) is rated for 3 amp. output with adequate heat-sinking and an applicable circuit for its use is described in the *1983 Radio Shack Semiconductor Reference Guide* (RS 276-4006). There is usually room inside the power supply cabinet to mount the required components, using the back panel as a heat sink for the regulator module.

If not, or if you wish to make up an adapter for portable use, a metal chassis box (such as RS 270-235) will provide a heat sink as well as shielding for the components. Shielded cable may be used for the DC power line to the computer to further reduce RFI. The chassis box may be covered with self-adhesive woodgrain paper to enhance its appearance if desired, except for the back heat-sink panel.

The regulator module must be isolated from the heatsink by using an insulated bushing and mica washer, such as the RS 276-1373 hardware kit. Apply heatsink compound (RS 276-1372) to both sides of the mica washer before

Figure 1.



mounting to ensure maximum heat transfer. If the LM 350T regulator is used to provide variable regulation, a 5-K variable resistor shunted by an experimentally-determined resistance connected in parallel will limit the highest output voltage to a pre-set value, nominally 9 volts. To raise the regulated output voltage of the 7805 from its rated 5 volts to 9 volts, solder a 330Ω and a 390Ω resistor in series to the center ("gnd") terminal of the regulator and the negative (-) lead from the power source. Solder the positive (+) lead from the power source to the No. 1 ("input") terminal of the regulator. Solder the positive (+) 9 VDC lead to the remaining ("output") terminal of the regulator. The negative (-) 9 V lead is connected to a common-ground terminal lug on the chassis box along with the negative (-) lead from the power source. Both 9 VDC leads are terminated in the mini-plug to the computer power jack. Be sure the plug tip is positive (+) 9 VDC and the barrel is negative (-) 9 VDC before plugging it into the computer.

Since only 7 VDC is required by the computer except during SAVE mode, an SPST switch may be added to provide both 7 V and 9 V from the one regulator. Connect the 390Ω resistor in shunt between the two switch lugs and insert the switch in series between the 330Ω resistor and ground (-). At the lower voltage the computer and the RAM pack may be left on for hours without overheating problems.

Enter these lines into the computer and RUN with the switch in the 7-volt position:

1 PRINT "■"; (Graphic space)
2 RUN

There should be no white lines or horizontal blank bar(s) appearing in the display of the large black rectangle. If white lines are present, the low-range voltage should be raised slightly by replacing the 330Ω resistor with the 390Ω and then placing the 330Ω where the 390Ω was. If LOADing problems now occur in the high-voltage mode which did not appear before changing the switch-shunt resistor, change this shunting resistance to its original value of 390Ω which should produce slightly over 9 V and the switch in high-range position.

If a single band of interference or a broad blank bar in the TV display gives indication of insufficient power supply filtering, try connecting a 2200 μF 50 WVDC capacitor to the positive (+) and negative (-) power-source leads at the regulator, observing proper polarity as marked on the capacitor. A 1000 μF 35 WVDC capacitor may suffice if space is a problem. *Caution:* Pull AC power plug before working on supply.

A lever-type "panic switch" (RS 275-016) and a voltage-indicating LED pilot light may be added also. Insert the micro-switch in the positive (+) 9 VDC lead near the computer power plug. Make the connections to the C and NC (normally-closed) switch-lugs. Solder a 1K resistor to the anode lead (opposite the flatted side) of the LED and in series to the switch-lug which is connected to the computer plug. Solder a 6.2 V zener diode (RS 276-561) to the other LED lead (cathode) and in series to the negative (-) 9 VDC conductor to the computer plug. The banded end of the zener diode must go toward the LED to function properly. At 7 volts or below, the LED will not be lighted, and by observing its normal brilliance level at 9 volts any abnormal voltage-variations will be apparent if they occur.

Figure 1 shows the relative placement of the components. It is not drawn to scale nor to the actual mounting locations, which will depend upon the type of box or cabinet used. ■

"ASTROLOGY"

FOR ZX-81/80/TIMEX (16K)

* CAST HOROSCOPES COMPLETE WITH CHART
* LOCATE PLANETS

ASTROLOGY COMPUTES THE POSITION OF THE PLANETS IN THE SKY FOR ANY TIME AND ALMOST ANY PLACE IN THE 20TH CENTURY. ALSO COMPUTED ARE SIDEREAL TIME AND JULIAN DAYS. THESE FEATURES MAKE "ASTROLOGY" USEFUL NOT ONLY FOR THE PURPOSE OF CASTING HOROSCOPES BUT ALSO TO ASTRONOMERS FOR LOCATING THE PLANETS. CAST HOROSCOPES FOR FRIENDS AND FAMILY AND PAY FOR "ASTROLOGY" MANY TIMES OVER!

DIGITAL POSI-LOAD TAPE WITH INSTRUCTIONS AND CHART $20.00

OPTIONAL—RECOMMENDED BOOK *THE ASTROLOGERS HANDBOOK* (HARDBOUND) BY SAKOIAN & ACKER—PUB. HARPER & ROW $18.50

HAM-AID
ZX81/80/TIMEX (2K)

* THE ELECTRONIC CALCULATOR

CALCULATE REACTANCE, RESONANCE, RESISTORS IN PARALLEL, AND EVALUATE EXPRESSIONS

POSI-LOAD TAPE WITH INSTRUCTIONS $8.00

Active Designs
1108 BILTMORE DR.
NASHVILLE, TN 37204
615-297-4755

DON'T LET GLITCHES, SPIKES OR POWER FAILURE WIPE OUT YOUR RAM PROGRAM AND DATA. AVOID SYSTEM CRASHES WITH

SYNC - SAVER
RAM BACKUP POWER FOR SINCLAIR

The Sync-Saver is a battery backup that protects your RAM against power interruptions. Simple to use, well engineered, it comes in 2 forms:

SVR-1. A **rechargeable** Nickel-Cadmium battery (included) system to maintain 1K to 16K RAM in the ZX80/ZX81/TIMEX for 1 hour. Batteries recharged automatically. Complete - ready to use.

SVR-2. An **economical** alkaline battery (not included) system to maintain ZX80/ZX81/TIMEX with 1K or 2K RAM for 1 hour. No battery recharge.

Both systems feature added **surge/transient suppression**, ON-OFF switch to reset or turn off computer, and DC ON pilot light.

SVR-1 . . . . . $49.00 SVR-2 . . . . . $17.50
Prices include postage and handling in U.S.
Foreign orders add $2.00
Send check or money order to:

LUXTRON Inc.
241 Winter St., Haverhill, Mass 01830

MUSIC SOFTWARE

VIRTUOSO features 10 octave range, whole to 32nd notes and rests at any tempo and YOU DON'T HAVE TO KNOW ANY MUSIC. Record songs or play through TV, amplifier or AM radio. For TS1000 and ZX81/2K or more. Cassette, guaranteed to load, $6.95 pp. Outside U.S. $9.95. Mail order only. **William Don Maples, Dept. C-1, 688 Moore Street., Lakewood, CO 80215.**

TIMEX/SINCLAIR Software

FREE CATALOG & Program Listing!!

Programmers/ Distributors Welcome!

J P R SOFTWARE
P.O. BOX 4155
Winter Park, FL 32793

AT&A

ZX80 AND MICROACE W/ 8K ROMS

"Assault on Darccos 16K"	$7.97
"Assault on Darccos 6K"	$7.96
"Atan 2K"	$4.96

ALL ON CASSETTES /SHIPPING INC
A.T&A Comp-U-Ware
2712 G. Street. Middletown. Ohio 45042

AT&A

Need a good game to play or program? Circle Chess board with instructions $5.00. Send your recorded Circle Chess games and programs for publication in Circle Chess Journal, Box 63, Des Plaines, IL 60017.

TIMEX/SINCLAIR

SINCLAIR ZX81/TS 1000 16K "ALPHA BASE" (on Cassette). Command your spacecraft from orbit to "ALPHA BASE" and return. Difficulty levels, impressive, challenging, $8.95. MICROGRAFIX, 306 Double Tree, Lewisville, TX 75067. Other software available.

8K Non-Volatile Memory Kit

Peter D. Hoffman

8K Non-Volatile Memory Kit. Hunter, 1630 Forest Hills Dr., Okemos, MI 48864. Complete kit: $29.95 plus shipping; PC board and manual: $15.00.

The Non-Volatile memory (NVM) kit is a battery backup powered RAM board that is primarily designed to fill the transparent address area between 8K and 16K in the Sinclair ZX80/81. The key feature of this product is that with the onboard battery, the routines stored in NVM are retained even with ZX81 power supply unplugged.

The transparent address area is not affected by the Sinclair operating system. Commands such as NEW do not disturb this area. This area is the ideal place to store machine language routines instead of in REM statements, string variables, or above RAMTOP. Thus you can develop your own system utilities, machine language subroutines, alternate display file, etc. Since this is RAM, the routine can be easily modified. For versatility this is even better than an EPROM. The NVM can also be used at any of the 8K blocks between OK and 32K.

The complete kit comes with instructions, PC board, all components, lithium battery, and one HM611P-3 CMOS static RAM chip. The one chip provides 2K RAM. The space and sockets will accept full complement of four RAM chips. Construction takes a leisurely four hours to complete.

The lithium battery provides 10 months of life with one 2K chip on the board and 2+ months with four of the standard RAM chips. There is available from suppliers (at a premium price) a low power version of the 6116 which uses only $\frac{1}{5}$ the power during idle.

The PC board is of very good quality and has several design touches that are nice extra features. A CPU reset pushbutton eliminates unplugging the power when crashes occur. There is a connection provided for a secondary backup battery, such as NiCads, which will further extend the life of the lithium battery. Extensive jumper connections are provided to handle the various options described in the documentation.

The instructions and documentation are strong points in this kit. The documentation is very complete and lucid. There is no trouble in following the construction instructions. The documentation includes parts list, schematic, lots of notes to cover the other options available, such as use of 2716/2732 EPROMs, EPROM/RAM mixture, or use with the ZX80. Finally, a sample program shows the use of a rapid secondary display file and utility programs for saving and reloading the NVM from backup tape.

I did have some initial problems with the contact between the NVM board and the Sinclair 16K RAM pack which piggybacks onto the NVM. The connector board simply needed to be cleaned to remove residual solder flux. Three was also a problem with defective retention of the memory. After much experimentation and modification, I found that this was occurring during the power transients and that the simple expedient of holding down the reset button while plugging/unplugging the 9V power cured the problem.

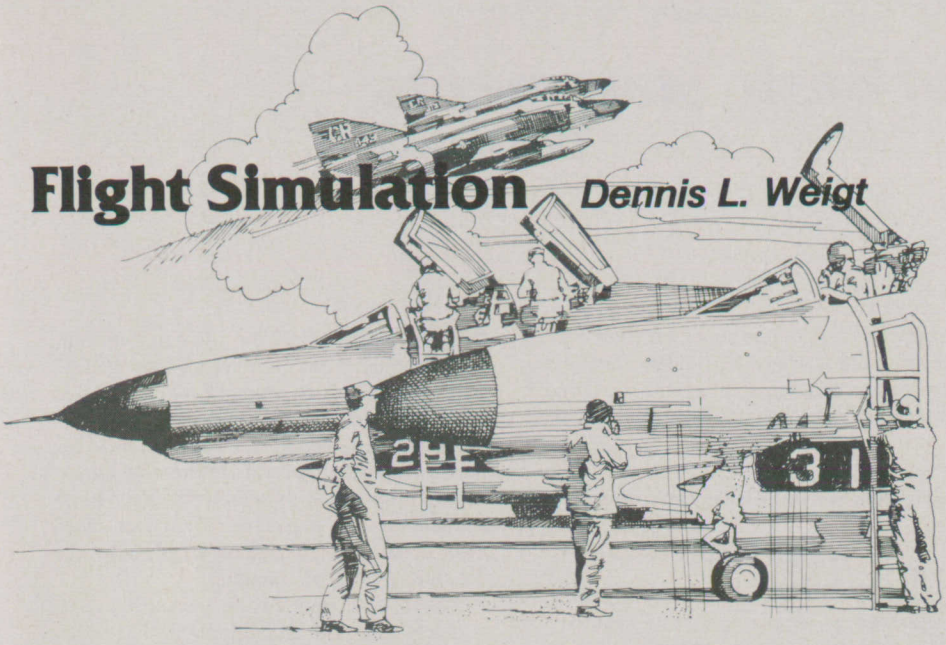
The edge connector to the computer is a wirewrap style with the wirewrap pins projecting through the NVM PC board to carry the signals to the 16K RAM pack. The small board, to which the 16K RAM pack connects, is placed between the wirewrap pins, the pins are bent inward and soldered to the board. This looks a little strange and awkward at first, but actually makes for a very sturdy assembly. The complete assembly of computer, RAM pack, and NVM makes a firmer connection with less wobble and crash problems than the original.

The ability to have utility routines available without having to do a tape reload at every session is a boon to a machine language programmer. This kit ranks quite high on the list of "must haves" for any serious machine language work.

Peter D. Hoffman, 5618 Martinique Dr., Corpus Christi, TX 78411.

Flight Simulation

Dennis L. Weigt



sync

SOFTWARE PROFILE

Name: Flight Simulation

Type: Cockpit/Navigation simulation.

System: 8K ROM; 16K RAM

Format: Cassette

Summary: A high quality flight simulator for the Sinclair. Very impressive graphics and instrument display.

Price: $9.95 + s&h

Manufacturer:

Gladstone Electronics
901 Fuhrmann Blvd.
Buffalo, NY 14203

Flight Simulation puts you at the controls of an airplane in midflight, and your objective is to navigate to the airport and land. This is something like saying your objective in pinball is to keep the ball in play: not as easy as it sounds.

The upper half of the screen is the aircraft windscreen, and through it the horizon can be seen, moving in response to the motions of the plane. The lower half of the screen is the instrument panel. The panel has indicators for power setting, flap extension, landing gear extension, rate of climb, fuel remaining, and a radio compass showing not only your true bearing, but the bearing of the navigation beacon you have selected.

Dennis L. Weigt, 910 Hancock, Manitowoc, WI 54220.

Your controls affect the pitch (climb/dive) and bank (turn right, turn left), the throttle, the degree of flap extension, and the status of your landing gear.

All this is only the first display. There are two other display modes.

First, is the map. This shows the surrounding area, including the runway, the various navigational beacons, and a cliff that rises 1500 feet (don't get too low). Also, your present location shows up as a flashing dot on the map.

Assuming that you have successfully navigated to the airport, the third display comes into view. On final approach, the instrument panel disappears, and the entire screen is a view of the approaching runway. As you head in, only three essential readouts are given to you. The airspeed, the altitude, and the ILS indicator. ILS is Instrument Landing system, and it shows you graphically whether you are high, low, or off-center on your approach.

On touchdown, the plane automatically brakes to a stop, and you are rated on your performance.

Overall, I feel this is one of the most impressive programs fo the Sinclair. The control responses are quick and fairly realistic, the instrument panel is very well done, and the final approach is exciting.

Faults? A few, but they are minor: 1) the limits on the bank and pitch you can achieve; 2) in real life you *can* recover from a stall, but not in the simulator; 3) no matter how steep you dive, once you lose power you lose airspeed till you stall.

Still, overall, it is a fantastic program. I thought it was worth the money when it was $24.95; at $9.95 it is a bargain. ■

TIMEX sinclair 1000

$85.00

ZX81-*Hardware*-TS1000

TIMEX-Sinclair 2020 Printer	$ 99.95
Mindware MW100 Printer	$129.95
Memopak 64K RAM Module	$174.95
Memopak 16K RAM Module	$ 58.95
Memopak IBM Style Keyboard	$ 99.95

ZX81-*Software*-TS1000

M.P. 16K Spreadsheet	$21.95
"TFO" 16-64K Data Filer	$23.95
Z-Text 16K Word Processor	$18.95
Inventory Control 16K	$21.95
"Gulp" maze game	$15.95

We Pay Shipping On All Orders

We feature Mindware, Memotech, and Timex products for quality and sophistication in both serious and recreational computing. All products are compatible with TS 1000 & ZX81 computers.

To Order: Send check, money order, or VISA/MC number and expiration date. MN residents add 6% sales tax.

Space doesn't permit a complete list of our products.

Write for our Free Descriptive Catalog.

E. Arthur Brown Company

Dept. SM-1
Alexandria, MN 56308

1702 Oak Knoll Drive
Ph: 612/762-8847

SINCLAIR ZX81/TS1000 SYSTEMS

—TSPlus base system includes wood enclosure, large keyboard with full features and ribbon connector for stability and future expansion

-Direct Video, battery backup, loading filters, expanded memory, etc. also available

-STD bus interface, among others, available to drive printers, disk drives, etc.

ORDER OUR BASE SYSTEM OR LET'S DESIGN YOUR SYSTEM TOGETHER

Base system - send your computer and $279.95 to:

DO LOOPS Computer

209 Maple Avenue
Harleysville, PA 19438

1471 E. 114th St., #2
Cleveland, Ohio 44106

FIVE VIDEO GAMES ONLY $2.95

Video listing for the ZX81 or TS1000 with 1K (1 prog. requires 2K). All games feature moving graphics. Package includes S-Invaders, Grandprix II, Astroid attack (not like astroids), Nuke 2K and Sinclair destroyer (softSync Sells identical copy of this public domain program for $7.42 on cassette).

Four 1K one 2K listing for only $2.95 + 70¢ postage and handling NY residence 21¢ sales tax

Frog Software Company, P.O. Box 95 Glenmont, NY 12077 or Call between 4-5 pm (518) 465-6552

*mention Sync Magazine and get an amusing but otherwise worthless program FREE

8K ROM
1K RAM

Deleting Blocks of Basic Statements

Don Kraska

On several occasions, I have had to delete a large block of Basic program statements from an existing program. For example, I developed a loader program to process "pseudo machine code" into actual absolute address machine language code. The loader is written in Basic and is several hundred statements in length. After the machine language code is debugged and running properly, I only want to retain the REM statements containing the machine code, not the loader. Deleting the loader program one line at a time is a tedious, time consuming process. I decided there had to be a better way.

Closer inspection of the chapter on system variables in the manual, uncovered the word NXTLIN at address 16425. The definition is:

SX2 16425 NXTLIN *Address of next program line to be executed.*

Don Kraska, 2101 Ledge Rd., Hinckley, OH 44233.

Suppose I put some statements just before the first line I wanted to delete, and some other statements just after the last line I wanted to delete. I should be able to calculate the total length of all the lines in between. Then I could POKE this length into a REM statement at the beginning of the block. The REM statement would then include all the statements I wished to delete. Deletion of the REM statement would delete the entire length. I thought this would work, since I had learned through experimentation that statement deletions are based on length only, not the ending ENTER character.

It does work. Figure 1 shows sample coding to delete lines 200 through 5000. The statements with line numbers which are not multiples of 10 are the statements necessary to perform the deletion. After adding the necessary statements, type in: GOTO 5001 and hit ENTER. You will stop with 9/199. Now delete lines 191, 192 and 5002. Lines 200-5000 will be deleted and also all the coding used to delete them.

Figure 1. Sample Deleting Lines 200-5000.

```
  10
   .       (10-190 ARE LINES
           TO BE KEPT)
 190
 191 LET S=PEEK 16425+256*PEEK 1
6426+3
 192 REM
 193 LET L=E-S-1
 194 POKE S,INT (L/256)
 195 POKE S-1,L-256*PEEK S
 199 STOP
 200
   .       (200-5000 ARE LINES
           TO DELETE)
5000
5001 LET E=PEEK 16425+256*PEEK 1
6426
5002 GOTO 191
5010
   .       (5010-9990 ARE LINES
           TO BE KEPT)
9990
```


SOFTWARE ZX81 - TIMEX-SINCLAIR 1000 HARDWARE

DR. FLOYD
Psychoanalysis by computer? - well, not quite but Dr. Floyd will carry on a conversation with you using psychoanalytic techniques giving the appearance of artificial intelligence. Requires 16K RAM. $10.95

GRAPHICS PAC I
An introduction to Sinclair graphics-includes: 2 random picture drawers, allow creation of "Pop" art. A screen formatter which allows placing any character anywhere on the screen. Complex pictures may be created & saved. Doodler allows line art drawings to be created & saved. Requires 16K. $10.95

WORD PLAY
Includes: "Jargon" - a jargon word generator. "Animal" - a fun game where the player teaches the computer all about animals. "Story" - the computer writes stories using the players input names, places, etc. Can be very funny for kids. "Haiku" - the computer composes HAIKU like poetry. Requires 16K. $10.95

SNAKES ALIVE
A group of arcade type snake games. You must evade, box in, capture or destroy. Fast moving and a lot of fun. Requires 16K. $12.95

All software is on high quality cassettes and is replacement guaranteed.

TO ORDER:
Send Check or Money Order
For the total plus:
$3.00 shipping (Software)
or $4.00 shipping (Hardware)
Calif. residents add 6% tax.
Phone orders: CALL
805/482-3604 24 HRS.
master charge VISA
For credit card orders, include all information on card.
DEALER INQUIRIES WELCOME

$45.95 SIN16
16K RAM
This RAM plug-in allows the user to run virtually all programs written for the ZX81 or TS1000. Completely assembled & tested. The reliable one.

$135.95 SUPER SIN64
64K RAM
This is the maximum directly addressable RAM that your ZX81 or TS1000 can use - Memory is used as follows: 0-8K Sinclair operating ROM. 8-16K switches in or out of use. Used for assembly language routines, memory mapped peripherals. Contents are safe from NEW and cassette (disc) loads thus allowing program-to-program communications. 16-32K BASIC and assembly language user program area. 32-64K large data arrays & BASIC variables.

All hardware is completely compatable with Sinclair add-on products. Both RAMS use the most reliable gold plated, bifurcated contact connector on the market.

10 day return privilege on all hardware-90 day parts and labor warranty-inexpensive extended service contract is available-
WE SERVICE WHAT WE SELL.

APROPOS TECHNOLOGY 350 N. Lantana Ave., Suite 821 • Camarillo, CA 93010

We'll keep your Sinclair summing!

OUR $14.95 SINCLAIR AND TIMEX OWNER-PROTECTION SERVICE PLAN WILL SAVE YOU MONEY.

Timex too!

Typical repair charges for a Sinclair ZX81 can run from $25 or $50 up to the replacement cost of the unit. So why take chances? MicroSync will guarantee unlimited service for one year, *parts included,* at one low price. With return postage and handling paid. Plus our VIP treatment for fast turnaround.

MicroSync's experienced technicians are ready to service your ZX81 or Timex/Sinclair 1000 with factory replacement parts. We'll return it promptly, and we'll quality-check your unit before it leaves our service center.

We made over 10,000 Sinclairs tick last year.

Sinclair equipment has a great reputation for reliability. But almost all computer equipment requires service at one time or another. We've been repairing Sinclairs ever since their first glitch.

MicroSync is THE Sinclair authorized Service Center.

Your Sinclair computer is a remarkable assembly of electronic components, some unique to Sinclair technology. Our Sinclair personnel have been trained on, and service *only* Sinclairs.

We have the experience it takes. We have the parts on hand.

So act now! If your unit is less than 90 days old you can purchase our Owner-Protection Service Plan for only $14.95.

Mail To: MicroSync
162 Marlboro St
Keene NH 03431

Please send Maintenance Agreements for the equipment listed below:

ZX81 or Timex/Sinclair 1000
Less than 90 days old (include proof of purchase) ..... **$14.95 ea.**
Over 90 days old ..... **$34.95 ea.**

16K RAM
Less than 90 days old (include proof of purchase) ..... **$12.95 ea.**
Over 90 days old ..... **$29.95 ea.**

Total Enclosed ..... **U.S. $** _____

Serial nos. _____

_____

☐ check ☐ M/C ☐ VISA

Card # _____ Exp. _____

Name _____

Address _____

City _____ State _____ Zip _____

MicroSync
AUTHORIZED SINCLAIR SERVICE

The fine print. MicroSync's Maintenance Agreement covers all parts and service for 12 months after the expiration of original warranty. For units over 90 days old, coverage is for 12 months from the date of the Maintenance Agreement. Kits or modified units may require a surcharge. MicroSync may not repair units damaged by abuse or negligence. Liability extends to repair or replacement only.

Math Support from Your ZX81

Raymond Fowkes

I am sometimes asked if a computer can do homework. The answer is "Not really," but there are some ways it can be a real help, especially in the area of math or algebra. The following program uses the functions of the 8K ROM to do this. It is made up of four sub-programs and, with 16K, each may be accessed by pressing the number shown on the screen until the new prompt shows up. If you have 2K RAM, the program should be entered as two separate parts: lines 10-750 excluding 20, and lines 600-890. With 1K, the first three sections (150-270, 300-400, 450-570) will have to be used as three separate programs.

The first routine takes any integer and displays its prime factorization. This has several applications including reducing fractions, finding common denominators, etc. Programs like this are not new, but this one is quite fast and can handle negative numbers.

The second part is similar to the first in that it finds the largest square factor of any integer, which is especially helpful in simplifying problems involving square roots.

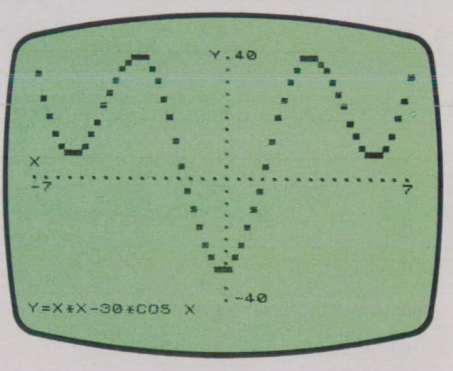
In the third program you are asked for the coefficients (a, b, and c) of a quadratic equation in the form $ax^2+bx+c=0$. From this, the equation will be displayed in standard form along with all real roots. For example, if you wanted to find all possible values of x where $2x^2-3x-5=0$, you would enter 2, -3, -5 and the computer would print: 2X"-3X-5=0, X=2.5 OR X=-1. Test them! (The quotation marks indicate the second power.) Here's another one: For $x^2+0x-9=0$ you would enter 1, 0, -9 and it would return: (X"-9=0, X=3 OR X=-3)

The fourth program is the most impressive. It draws the graph of any function, set of functions, or your own data with modification. First, enter your expression in terms of x; SIN X for example. Then enter any restrictions so the program does not stop with an error. In this case there are none, so press ENTER. Then enter the limit for the x axis (try 3), and then for the y axis (1 is the largest value for the SIN function) and watch while the graph is formed (if you are in the SLOW mode.) Try also (X*X-30*COS) no restrictions, x limit 7, y limit 40.

Some expressions do require restrictions, for instance for (SQR X/(X-3)) the restrictions would be (X>=0 AND X<>3). Notice that by using different axis limits you can squeeze or stretch the graph for the best effect. For the true proportions, the ratio of the length of the x axis to the y axis should be 3 to 2.

Now, suppose you wanted to graph the equation ($y=\pm$SQR x) After entering the alternate lines 870-920, you could first graph (SQR X, X>=0) (6 and 4 are good limits.) Then, when this is done and the string input appears, enter "-SQR X" and then the restrictions "X>=0" to make the graph complete. To start a new one, press ENTER instead of a new expression.

The other modification, alternate lines 810 and 830, allows you to graph your own set of data. Ignore the request for an expression and enter X>0 as the restriction (if that is where your graph starts). Then let the x limit be the number of data points and let y be their upper limit. Finally, enter your numbers one at a time. ■




```
  10 PRINT AT 6,4;"1 - PRIME FAC
TORS";AT 8,4;"2 - SQUARE FACTOR"
;AT 10,4;"3 - QUADRATIC EQUATION
"
  20 PRINT AT 12,4;"4 - GRAPH PL
OTTER"
  30 PAUSE 4E4
  40 CLS
  50 GOTO VAL INKEY$*150
 150 PRINT " INPUT NUMBER TO BE
FACTORED"
 160 INPUT A
 170 LET B=2
 180 LET C=A
 190 CLS
 200 FOR B=B TO SQR ABS A
 210 IF A/B=INT (A/B) THEN GOTO
250
 220 NEXT B
 230 PRINT A;"=";C
 240 RUN
 250 PRINT B;"*";
 260 LET A=A/B
 270 GOTO 200
 300 PRINT " INPUT NUMBER TO BE
FACTORED"
 310 INPUT A
 320 CLS
 330 FOR B=SGN A TO A/4+SGN A ST
EP SGN A
 340 LET C=SQR (A/B)
 350 IF INT (C*1E6)/1E6=INT C TH
EN GOTO 390
 360 NEXT B
 370 PRINT A;"  NO SQUARE FACTOR
S"
 380 RUN
 390 PRINT "(";C;"*";C;")";"*"+S
TR$ B  AND B<>1;"=";A
 400 RUN
 450 PRINT " INPUT A,B,C FOR AX"
"+BX+C=0"
 460 INPUT A
 470 PRINT AT 3,7;STR$ A AND A<>
1;"X"";"
 480 INPUT B
 490 PRINT ("+" AND B>0)+STR$ B+
"X" AND B;
 500 INPUT C
 510 PRINT ("+" AND C>0)+STR$ C
AND C;"=0"
 520 PRINT
 530 LET D=INT (SQR (B*B-4*A*C)*
1E7)/1E7
 540 PRINT "X=";(D-B)/2/A;" OR X
=";(-B-D)/2/A
 550 PAUSE 4E4
 560 CLS
 570 RUN
 600 POKE 16389,128
 610 CLS
 620 PRINT "ENTER EXPRESSION FOR
Y","IN TERMS OF X"
 630 PRINT AT 4,0;"Y=";
 640 INPUT A$
 650 PRINT A$;AT 8,0;"ENTER REST
RICTIONS ON X"
 660 INPUT B$
 670 CLS
 680 PRINT "X AXIS LIMIT?  Y."
 690 FOR X=1 TO 10
 700 PRINT ,"."",","."
 710 NEXT X
 720 PRINT "Y=";A$;"  ";B$;AT 9,
0;"X"
 730 FOR X=1 TO 16
 740 PRINT "..";
 750 NEXT X
 760 INPUT U
 770 PRINT -U;TAB 32-LEN STR$ U;
U;AT 0,0;"Y";
 780 INPUT Z
 790 PRINT TAB 17;Z;AT 20,17;-Z;
AT 0,0;"
 800 IF B$="" THEN LET B$="1"
 810 FOR X=-U-U/15 TO U+U/30 STE
P U/30
 820 IF NOT VAL B$ THEN GOTO 860
 830 LET Y=VAL A$
 840 IF Y<-Z OR Y>Z+Z/20 THEN GO
TO 860
 850 PLOT 30/U*X+32,20/Z*Y+22
 860 NEXT X
 870 PAUSE 4E4
 880 CLS
 890 RUN
```

Raymond Fowkes, PO Box 336, Coalinga, CA 93210.

BYTE-BACK modules

64-K MEMORY $119.95 KIT

WIRED and TESTED $129.95

IN STOCK!

SAME DAY SHIPMENT!

WHY PAY MORE?

BYTE-BACK'S M-64 extends the memory of your ZX81 or Timex-Sinclair 1000 to a full 64-K. It's user transparent. It plugs directly into the back of the ZX81 and has an expansion port to allow you to still use a printer. No extra power supply is required. It has all standard features **plus** the area from 8-16-K can be switched out in **2-K** increments for memory mapped peripherals, PROMS, etc. Same proven reliability as our M-16 with thousands in use.

INSTANT INFORMATION WITH BYTE-BACK'S MD-1

IN STOCK

MODEM *only* $119.95 KIT

WIRED and TESTED $149.95

Use your phone to connect your "LITTLE" ZX81 to the "LARGEST" computer networks in the world. With **BYTE-BACK's MD-1 MODEM** connected all you do is dial a phone number (usually local), press a few keys and watch the data appear on your TV screen. (Software is included) This **MODEM** can be used in either the "originate" or "answer" mode with selectable baud rate.

You can have immediate access to:

UNIVERSITY COMPUTERS,DOW JONES, UPI, AND MORE !

As an extra bonus an RS-232 port is provided to allow you to drive all standard RS-232 peripherals. (75 to 9600 Baud)

EXPAND YOUR 16K SYSTEM (M-16) $59.95 KIT

WIRED and TESTED $69.95

If you have a Sinclair 16K RAM module and need more memory, expand it to 32K and beyond by using **BYTE-BACK M-16 MEMORY MODULES.**

You can't connect two Sinclair 16K RAM modules together, but you can connect one Sinclair 16K and one or more **BYTE-BACK 16K** modules to get all the memory you need.

THOUSANDS IN USE WITH PROVEN RELIABILITY

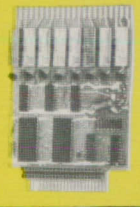
IN STOCK — SAME DAY SHIPMENT

BYTE-BACK'S BB-1 CONTROL MODULE

$59.00 KIT *In Stock!*

WIRED and TESTED $69

- **8 Independent Relays** *(with LED status indicators)*
- **8 Independent TTL Inputs** *(with Schmitt trigger buffers)*



- By using a single POKE command you can change and latch the status of each of the 8 relays.
- Your **ZX80/1** can read the status of all 8 inputs by the use of a single PEEK command.
- A comprehensive manual is included that has complete application details.

RS-232 Module $59.95

WIRED and TESTED $69.95 IN STOCK

Allows you to connect ZX81 to all RS-232 printers & terminals.

ALL MODULES CARRY 90-DAY WARRANTY

TRY BYTE-BACK MODULES FOR 10 DAYS WITH NO OBLIGATION

Remember with:* BYTE-BACK *modules you are NOT limited to using only one module at a time!

BYTE-BACK CO.
RT. 3, BOX 147 • BRODIE RD.
LEESVILLE, S.C. 29070
Ph. (803) 532-5812

☐ M-64 Kit	$119.95	☐ M-16 Kit	$59.95
☐ M-64 Wired and Tested	$129.95	☐ M-16 Wired and Tested	$69.95
☐ M-64 Blank PC Board	$19.95	☐ M-16 Blank PC Board	$19.95
☐ BB-1 Kit and Manual	$59	☐ Modem Kit	$119.95
☐ BB-1 Wired and Tested and Manual	$69	☐ Modem Wired and Tested	$149.95
☐ BB-1 Blank PC Board and Manual	$29	☐ RS-232 Module Kit	$59.95
		☐ RS-232 Module Wired and Tested	$69.95

Shipping and Handling $4.95

ORDER PHONE (803) 532-5812 **Bill My** ☐ Visa ☐ MasterCard

Exp. Date _____ Card No. _____

Name _____

Address _____

City/State/Zip _____

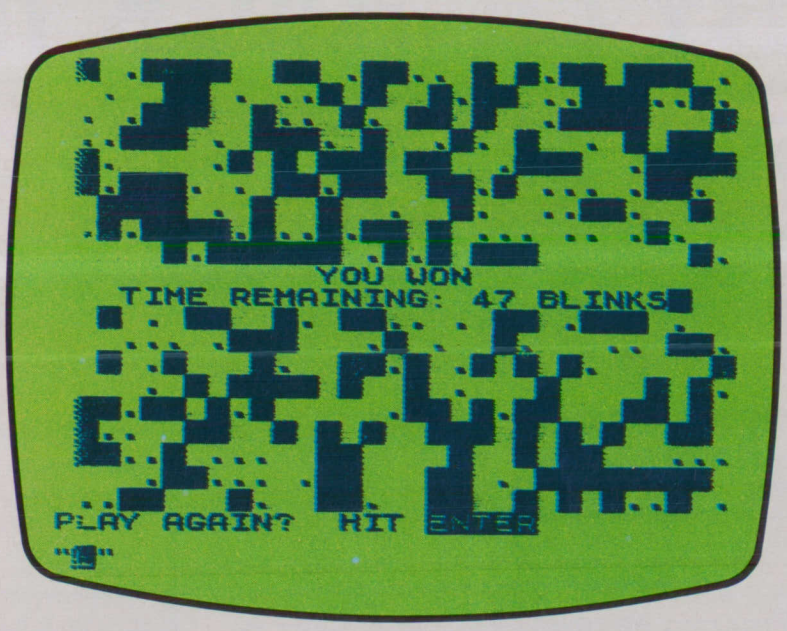
Mail To: **BYTE-BACK CO. • Rt. 3, Box 147 • Brodie Rd. • Leesville, S.C. 29070**

VISA

CHECKS

MasterCard

ZX Maze



Thomas B. Woods

Have you dreamed of writing a graphics game complete with maze, treasure, and gobbling hunter? Perhaps you figured out how to move your man and draw the maze, but how in blazes do you teach your treasure seeker that he cannot just march through walls to collect his prize?

Finding a way around this dilemma had me banging my head against the wall until I discovered that the secret lies in mapping the display and then checking points of action against that map to keep everything within the rules.

This program "ZX Maze" does just that by charting the TV screen with a numerical array. Each value of the array corresponds to a point in the maze. Depending on the assigned value of the point, the roving treasure hunter proceeds through the maze, bumps into a wall, loses or collects points, or finds his treasure.

"ZX Maze" fits in ZX81 or Timex/Sinclair 1000 computers with 16K RAM. After entering the program, type RUN and ENTER. First a random maze and bonus dots are drawn. Then the treasure ($) and blinking gobbler (0) are also randomly placed. Move the man by pressing one of the arrow keys 5, 6, 7, 8. Since everything is positioned randomly, you or the treasure (or both) could materialize inside a wall or closed room with no chance to win. The solution to this minor problem was to give the man a blaster. Push S and the man blows a hole through anything. Watch out though because you could blow up the treasure.

The object of the game is to take the treasure within an alloted amount of time (50 blinks of the man). Using your blaster costs you 9 blinks, but for every bonus dot you gobble, you gain a blink. If you manage to land on the treasure without running out of blinks, the program proclaims your victory in flashing lights. If you run out of time or if you are a little too trigger happy on your blaster, the program says, "YOU LOSE." In either case the blinks remaining are PRINTed and the computer gives you the option to play again.

How the Program Works

In line 5, C is the clock. You start off with 50 blinks. Increase the value of C to make the game easier.

At line 10 the numerical array A(21,31) is dimensioned. This array is a map of the video screen. Each point on the screen corresponds to a point in the array. A(X,Y) would equal the X,Y coordinates of a screen location. At this stage all values are 0.

Lines 20 to 90 print the maze. In line 40, if a random number between 1 and 10 is greater than 5, you GOTO 70 where a maze wall is PRINTed.

If the random number is less than or equal to 5 you skip line 40 and proceed to 42 where a corridor gives the array position a value of 1.

Next, line 45 acts just like 40, but this time you GOTO 61 to PRINT bonus points. Array values for these are set at -1 in line 62.

When the loop is finished, lines 100 to 150 come into play. In turn they select random X and Y coordinates on the screen for the treasure ("$") and the man. Line 130 gives the treasure a value of 10 in the array.

Line 155 initializes L$ which is used in the man moving routines.

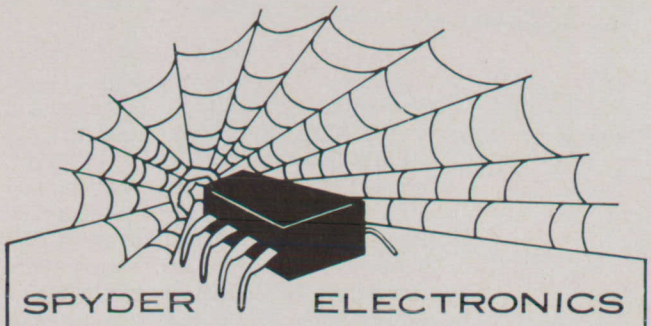
Then lines 157 to 250 act as a keyboard scanning cycle. First, line 160 prints the man. 162 checks for win or lose conditions. If one is met, you GOTO 2000. If not, then line 163 adjusts the time remaining. If the man is sitting on a ".", A(Y,X) will equal -1 so C will increase: C-(-1) is the same as saying C+1. But the next line, 164 changes the value to a blank space so the next time you land there you will not get another bonus blink.

Lines 165 to 190 check if you are pushing a key. At 165, L$ is given the same value as INKEY$, but if you are not pressing a key, L$ will remain unchanged. Once the man starts moving, this line keeps him going in the same direction until you press a key to change it.

At line 170 the computer looks for the arrow keys. If an arrow was pressed, you will GOTO either 500, 600, 700, or 800 where the man is moved.

The instruction at line 180 blinks the man between positions.

Thomas B. Woods, PO Box 64, Jefferson, NH 03583.



SPYDER ELECTRONICS

presents the

SPYDER CHARACTER BOARD

. Play and create high resolution games
. Create your own character sets
. Includes 2K of memory
. Use easy to read reverse video
. Compatible with RAM Packs and ZX Printer
. Installs easily (complete instructions included)

Included with the Spyder Character Board:
- Full documentation to get the most from your ZX81
- Demo tape with character sets
- Zap-Em high resolution game
- Spyder Software Catalog

Bare Board -$14.50
Kit -$24.50
Assembled -$29.50

Add $2.50 for postage and handling

Send check or money order to:
USA funds only

SPYDER ELECTRONICS
P.O. Box 4172
Morgantown, WV 26505

ZX-FORTH™

Now you can have the SPEED and POWER of computers costing hundreds or even thousands of dollars more inside your ZX81. FORTH is now available on cassette for the 16K ZX81/TS1000. *EASIER* to learn than BASIC and the most powerful language available for the ZX81 *10 TO 20* times *FASTER* than BASIC and typically uses less than *HALF* the amount of RAM space needed by an average BASIC program. Includes extentions for speedy graphics handling, as well as basic data handling functions. Sample programs written in FORTH included at no extra charge are: Scratchpad, a simple word processor, and Breakforth, an arcade-type game. Also included is a complete bibliography and information about fig-FORTH, the international FORTH users group.

Find out why FORTH is gaining worldwide support as the state of the software art and have fun learning about computers the fast and easy way.

THE FORTH DIMENSION
1451 N. UNION STREET
MIDDLETOWN, PA 17057

ZX-FORTH™ 16K CASSETTE $34.95
Add $2.00 shipping and handling.
Add $7.00 shipping and handling for foreign orders.

SINCLAIR OWNERS

RCO Technical took a HARD LOOK at the cost of SOFTWARE for 16K ZX81 & T/S 1000 computers.

Our findings? We can do BETTER!

***CHECKSTUB**—Checkbook management program with the analytic POWER you need to find out where your money is going. Thirty user definable budget categories. Innovative displays.

***EZ-HEX**—Hex code utility. Write-edit-test Z80 machine language programs in hex code. Excellent programming aid. Easy to use and FAST.

***Z-WRYTER**—Word processor. Write, edit, and save text using powerful editing functions that make writing enjoyable. Supports ZX printer.

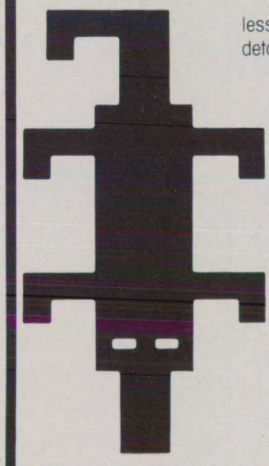
***PROFIT PLAN**—Profit analysis. Calculates break-even point – profit projections using entered fixed & variable cost data.

$9.95 Each plus $1 shipping 16K req
Send check or M.O. to:

RCO Technical
P.O. Box 773A
St. Ann, MO 63074

For ZX81/TS1000 with 16K

KROK



Better than Pac-Man. Split-screen, split-second timing, action packed adventure. Left portion of screen shows your progress through multiple levels of a complex maze, pursued by relentless crocodiles; upper right portion of screen shows details of each room. Encounters with graphic spiders, snakes, bats, monkeys. Find treasure, coins, keys, ring, codes, a silver dagger. Engage in kill-or-be-killed struggles. Break code and find hidden doors to additional complex subterranean adventures. $8.95.

CRYPTO-WHAMMER

Use this program to solve cryptograms, break codes. Displays original code at top of screen, changes as code is broken below. Performs character counts. $6.95

Brown Cottage Industries
5486 Bright Hawk Court
Columbia, Md. 21045

Dear Friends:
Please send me ☐ KROK, ☐ CRYPTO-WHAMMER. Please send my order to:

Name_____
Address_____
City, State_____ Zip_____

☐ I have enclosed a check or money order.
☐ Please charge my VISA or Mastercard (circle) No: _____

```
  1 REM
  2 REM
  3 REM
  4 REM
  5 LET C=50
 10 DIM A(21,31)
 20 FOR N=1 TO 30
 30 FOR Q=1 TO 20
 40 IF INT (RND*10)>5 THEN GOTO
70
 42 LET A(Q,N)=1
 45 IF INT (RND*10)>5 THEN GOTO
51
 50 NEXT Q
 55 NEXT N
 60 GOTO 100
 61 PRINT AT Q,N;"."
 62 LET A(Q,N)=-1
 63 GOTO 50
 70 PRINT AT Q,N;"■"
 90 GOTO 50
100 LET X=INT (RND*28)+2
110 LET Y=INT (RND*16)+2
120 PRINT AT Y,X;"$"
130 LET A(Y,X)=10
140 LET X=INT (RND*28)+2
150 LET Y=INT (RND*16)+2
155 LET L$="X"
157 SLOW
160 PRINT AT Y,X;"O";AT Y,X;"*"
162 IF C<=0 OR A(Y,X)=10 THEN G
OTO 2000
163 LET C=C-A(Y,X)
164 IF A(Y,X)=-1 THEN LET A(Y,X
)=1
165 IF INKEY$<>"" THEN LET L$=I
NKEY$
170 IF L$>="5" AND L$<="8" THEN
GOTO 100*VAL L$
180 PRINT AT Y,X;" "
190 IF INKEY$="5" THEN GOTO 100
0
250 GOTO 160
500 PRINT AT Y,X;" "
510 IF X>2 THEN IF A(Y,X-1)<>0
THEN LET X=X-(X>2)
520 GOTO 160
600 PRINT AT Y,X;" "
```

```
610 IF Y<20 THEN IF A(Y+1,X)<>0
THEN LET Y=Y+(Y<20)
620 GOTO 160
700 PRINT AT Y,X;" "
710 IF Y>2 THEN IF A(Y-1,X)<>0
THEN LET Y=Y-(Y>2)
720 GOTO 160
800 PRINT AT Y,X;" "
810 IF X<30 THEN IF A(Y,X+1)<>0
THEN LET X=X+(X<30)
820 GOTO 160
1000 PRINT AT Y-1,X-1;" * ";AT Y
,X-1;"*■*";AT Y+1,X-1;" * ";AT Y
-1,X-1;"   ";AT Y,X-1;" O ";AT Y
+1,X-1;"   "
1010 FOR Q=Y-1 TO Y+1
1015 PRINT AT Y,X;"*"
1020 FOR N=X-1 TO X+1
1025 IF A(Q,N)=10 THEN GOTO 2000
1030 LET A(Q,N)=1
1035 PRINT AT Y,X;"O"
1037 LET C=C-1
1040 NEXT N
1050 NEXT Q
1060 GOTO 160
2000 FOR B=1 TO 7
2005 IF A(Y,X)=10 THEN PRINT AT
10,0;"[redacted]* YOU WON *[redacted]
[redacted]";AT 10,0;"[redacted]* YOU
WON *[redacted]";AT 10,0;"XXXXXX
XXXX* [redacted] *XXXXXXXXXX";AT 10
,0;"********** [redacted] ********
***";AT 10,0;"                YOU WO
N                "
2010 IF A(Q,N)=10 OR C<=0 THEN P
RINT AT 10,0;"[redacted]
[redacted]"
2020 NEXT B
2025 IF A(Q,N)=10 THEN PRINT AT
10,0;"    YOU BLEW UP THE TREASU
RE    "
2027 PRINT TAB 2;" TIME REMAININ
G: ";C*(C>0);" BLINK5"
2030 PRINT AT 21,0;"PLAY AGAIN?
 HIT [redacted]"
2040 INPUT A$
2050 CLS
2055 FAST
2060 RUN
```

Graphics line notes:

1: ZX MAZE.

2: (C) 1982.

3: Thomas B. Woods.

70: Inverse space.

1000: Inverse letter O.

2005: F,G,F,G,F,G,F,G,F,G; G,F,G,F, G,F,G,F,G,F; inverse X (10); inverse X (10); inverse YOU WON; inverse YOU WON.

2010: Inverse space (12); inverse YOU LOSE; inverse space (12).

2030: Inverse ENTER.

190 checks to see if you want to use the blaster. If you are pushing S when the computer comes to this line, you will GOTO 1000, an explosion routine.

Lines 500 to 520 and then 160 move the man from right to left, the direction of the arrow on the 5 key. The remaining lines to 820 also move him down, up, and from left to right in the same manner. Before the actual change is made, the computer checks the array value of the next position. It will proceed only if the array value is not zero: i.e., not a wall.

As stated before, line 1000 is an explosion which executes if you were pressing S. Lines 1010 to 1060 fix the new values of the array since you are removing portions of the maze with each blast. Line 1020 checks whether you blew up the treasure. If you did, you lose at 2000.

2000 to the end is the win/lose display. If the man's array position equals 10, line 2005 gets PRINTed. If the explosion points are 10 or if you run out of time, line 2010 gets displayed.

Play the game to see just how screen mapping works. You can add all kinds of complexities for the graphics to interact with.

If you come up with something interesting, I would be interested in seeing it. ■

Tape Load Anxiety?

Don't spend a fortune on a disk drive until you try our:

L&G Vu-Load Volume Monitor

- insures program *load* every time
- monitors tape output level
- gives positive *save* indication
- detects blank tape without disconnecting cassette wires
- ready to use—no wiring

Level-Vu Prism

Let's you see recessed tape counter without moving from seat

- attaches easily to recorder body or lid
- fits most recorders including Radio Shack, Vic-20, Atari
- magnifies counter numerals

Vu-Load Monitor $20.95 + 2.50 p & h

Level-Vu Prism $3.95 + 1.00 p & h

L&G Enterprises
P.O. Box 6854
Silver Spring, Md 20906
(301) 774-0126

2 AMP POWER SUPPLY

FOR ZX80/81/MICROACE

As you expand your system you'll need more power to run it. This supply has it!

2 Amp Power Supply $19.95
Plus $2.50 Shipping/Handling
Illinois residents add 6%

POWER LINE FILTER

Protect your system from power line R.F. interference and transients that can cause unnecessary program crashes.

5 Amp Filter Kit $23.95
Assembled & Tested $29.95
Plus $2.50 Shipping/Handling
Illinois residents add 6%

MAIL CHECK OR MONEY ORDER TO:
HURRICANE ELECTRONICS
P.O. Box 87 • Dolton, IL 60419

WANTED

DISTRIBUTORS

Get in on the SINCLAIR ZX81 and TIMEX-SINCLAIR 1000 Computer GOLDMINE

Market our software for **BIG** profits. Exclusive sales rights in your area. Send for the complete story on this exciting new and profitable opportunity.

This is limited offer so act now !

Start your OWN business - we will help get you started.

OPEN TO: Individuals and Computer Retailers

SOFTWAREHOUSE
P.O.Box 5367 N. Hollywood, Cal. 91616

BUSINESS AND HOME SOFTWARE TAPES

EZ BOOKKEEPING $15.95
CHECKING .....$ 9.95
WORD PROCESSOR $13.95
5 BUSINESS PROGRAMS $10.95
MACHINE CODE NIT-PICK $10.95
LIST FOR TOP 3 PROGRAMS .....$ 5.95 (EACH)

SEND SASE FOR DETAILS
FREE COD CHARGES

*

PHONE YOUR ORDER TODAY (24 HOUR)
CALL (414) 276-8787

FOR INFORMATION: (414) 843-3990
P/P FOR JIM UNTIL 10 PM. C.S.T.

MAIL ORDER: 5% OFF FOR M.O.
ORDER FROM: C.E.D. CORPORATION
P.O. BOX 222, SALEM, W. 53168

*** EXPERIENCE SINCE 1970 ***

SINCLAIR
ZX81/TS1000

NYLON FORM FITTING DUST COVER

ONLY $11.95*

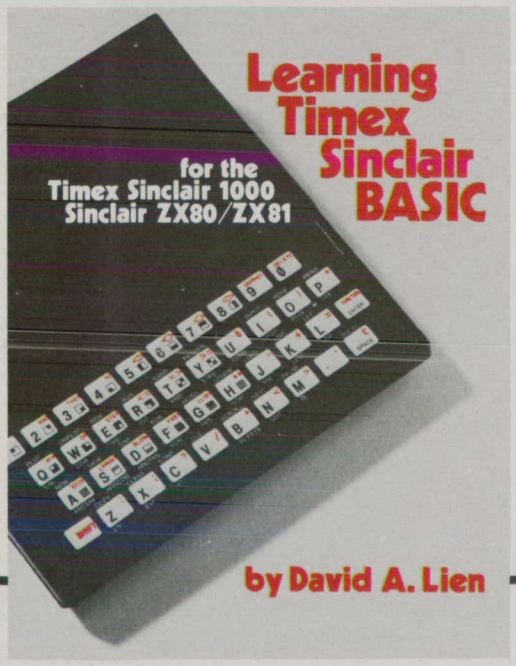
Protect your ZX81 from dust, grime and spills with a quality dust cover from The Computer Trader. The form fitted cover provides protection during storage or transport. Available colors: black, tan, royal blue, brown, navy blue and burgundy.

DEALER & DISTRIBUTOR INQUIRIES WELCOME

Please include $1 postage and handling. Allow 1-3 weeks for delivery. Specify color and amount. *California residents add 6% sales tax.

The Computer Trader
P.O. Box 20976
San Diego, CA 92120 **(619) 283-9273**

FOR TOTAL CONTROL
of Your Timex Sinclair



The Only Programming Manual You'll Need

Learning Timex Sinclair BASIC, Dr. David Lien's new, 350-page, comprehensive manual for the Timex Sinclair 1000 and Sinclair ZX80/ZX81, is the one book that answers all your programming questions.

Learning Timex Sinclair BASIC's simple, step-by-step instructions make it ideal for the classroom. And it's a must for all Timex Sinclair owners, especially first-time computer users. Don't miss this opportunity to learn from a proven teacher of BASIC how to write your own custom software.

Don't waste time with other confusing, incomplete programming guides — order *Learning Timex Sinclair BASIC* now. Fill out the coupon or call our 24-hour order line at **800-854-6505**, in California call **619-588-0996** (8:00 a.m. - 5:00 p.m.).

30-Day Money Back Guarantee
If you're not totally satisfied with this book for any reason, return it to Compusoft in salable condition within 30 days for a full refund.

CompuSoft® Publishing
535 Broadway, Dept. #070383
El Cajon, CA 92021

Please send _____ copies of Learning Timex Sinclair BASIC at $14.95 each (Calif. residents add 6%) plus $1.65 shipping and handling per book within the U.S. Foreign orders, include $2.50 surface shipping and handling per book.

Total Enclosed _____

Name _____

Address _____

City/State/Zip _____

☐ Check ☐ Visa ☐ MasterCard

Account # _____ Expiration Date

_____
Signature

Please allow 4 to 6 weeks for delivery. 070383

Minotaur

Fred Nachbaur

This active-animation program displays a full-screen picture of a maze, and shows your progress through it to its only exit. Meanwhile, the Minotaur (a mythical half-man, half-bull creature which inhabited the Labyrinth at Minos) is on the prowl and determined to have you for lunch!

This program, as originally written, used a technique common to many such maze games–storing the game "field" in a string array. Each location in the array corresponded to a point on the screen, allowing the computer to keep track of the GO/NO-GO areas, as well as the locations of "you" and the "Minotaur."

In order to make this game fit into 2K RAM, however, a different approach must be used; a 20 by 30 string array takes up about 600 bytes of memory. When this is added to the memory required by the display file and the system variables (about 850 bytes), all we would have left is about 600 bytes for program and variables--hardly enough memory for even a rudimentary maze game.

Notice that when you use an array to provide the playing field, the data on the screen is duplicated in the array. So why not use the display file itself as the playing field? We could thus get rid of the array and have effectively twice the memory to put our program and variables into.

Fortunately, this is quite possible even on the ZX81/TS1000 with its flexible display file. Since we will be displaying a full-screen, the display file will be "padded out" to 24 lines of 33 characters each (32 columns plus the ENTER character CHR$118 that marks the end of each line). We will use only the 22 lines usually used for output display, and will reserve the first and last lines and the first and last columns for our boundary, resulting in a 20 by 30 playing field.

Since the display file is located directly above the program area, it does not have a fixed starting address. Instead, one of the system variables (at 16396 and 16397) gives the starting address of the display file.

More exactly, it gives the last byte of the program area; the first byte of the display file is thus the value in D-FILE plus one. To get the value of D-FILE, use the expression

PEEK 16396 + 256 * PEEK 16397

Fred Nachbaur, SyncWare Co., 4825 Elrovia Ave., El Monte, CA 91732.

The program does this in line 90, assigning the value to the Basic variable DF.

The starting address of the display file is "looked up" each time the program is used, so even if you change the program length (altering the location of the display file) the program will still work.

Lines 100 to 150 "fill" the maze picture, sequentially filling each location

with either 0 (CHR$ 0 = space) or 128 (CHR$ 128 = inverse space) to define the GO/NO-GO areas. Which character is inserted depends on whether RND is less than density variable DN or not; if DN is set to, say 0.25, then 25% of the screen locations (on the average) will be blacked in.

By now you may have noticed a conspicuous absence of numbers within the program; the arguments of functions and operations are single-letter numeric variables containing a fixed integer in most cases. For example, instead of saying PRINT AT 1,5; we accomplish the same result by LET P=1 and LET S=5, then saying PRINT AT P,S;.

This might seem like a terribly awkward way to write a program; it certainly makes it more difficult to follow when reading, but it saves memory. Every number in a program line takes six bytes of memory that: 1) tell the computer it is a number (1 byte), and 2) give the floating-point binary representation (5 bytes).

If many numbers are used, it will therefore take a good number of bytes more than the number of keystrokes in the program. Numeric variables, however, are stored beyond the program area and display file, and their representations within the program take only as many bytes as there are letters in the name of the variable.

So, while it takes 11 bytes to store the number 16396, it takes only 1 byte to store K, where we have previously LET K = 16396 in the immediate mode (no line number). Of course, it takes 6 bytes to store K in the variables area, so not much is saved if the number is only used once. Frequently used numbers, on the other hand, will save a good amount of memory since the binary representation is stored only once, in the variables area. Similarly, instead of"16397" we could use "K+P", where K=16396 and P=1, and still save memory.

For maximum memory conservation, these constant variables should be defined in the immediate mode; that way, you do not use up space defining them within the body of the program. One warning, though: this technique will cure you of compulsively using RUN, as it first clears all variables. Use only GOTO to start the program after all the variables have been manually entered; RUN (and CLEAR, of course) are strictly off limits.

Back to the program. If we call the line number of our maze H, and the column number I, then we can address the corresponding point in the display file using the expression DF+H*33+I (or DF+H*L+I where L=33). Note that in this case, H ranges from 1 to 20 (taking into account the top border) and I ranges from 2 to 31 (taking into account the left border and the fact that DF points to the last byte before the first display file element). To change a specified element in the display, we can POKE DF+H*33+I, (code of desired character); PEEKing the expression gives the code of the character at position H,I.

Note the analogy between this way of addressing the screen and PRINT AT H,I;"(character)". In this game, the actual locations do not correspond ("I" is off by one location but this can be easily modified if it is useful to have the PRINT positions match the POKE positions, for example, POKEing DF+H*33+I+1.

You thus have an alternative display method to PRINT AT; the charm of it is that POKEing a character into the display file does not change the PRINT position, and is quite useful where it might

Get the most from your Timex Sinclair or Sinclair computer.

Get THE BEST OF SYNC!

Here's the best from *Sync*, the exciting magazine devoted to Sinclairs!

The Best of Sync is a collection of more than 80 of the most valuable articles, programs, tutorials and reviews that appeared in Volume One of *Sync*, the magazine for Timex Sinclair and Sinclair owners.

This information-packed book is a vital resource for anyone who'd like to get more work (and more fun!) from a Timex Sinclair 1000, a Sinclair ZX81 or ZX80, or a MicroAce computer. Topics covered include:

- Games
- Mathematical applications
- Graphics techniques
- Software programming
- Translation
- Machine language hardware
- Resource listings
- Product reviews
- Complete glossary

In *The Best of Sync* you'll find game programs like "Forest Treasure" and "Motorcycle Race Game"...hardware plans for a "Key Click Generator" and a "Parallel Interface"...programming features on "Handling Character Strings in the ZX80," "Converting from Other BASICs" and "An Introduction to Machine Code." And that's just a small sample.

These ultrapractical features appeared in issues of *Sync* that are now out of print and nearly impossible to find. But you can still make use of the important information, techniques and programs they contain—by ordering *The Best of Sync* today!

Also available at your local bookstore or computer store.

8½" x 11", softcover.

For faster service, PHONE TOLL FREE: 800-631-8112
(In NJ only: 201-540-0445)

CREATIVE COMPUTING PRESS
Dept.4A9S, 39 East Hanover Avenue, Morris Plains, NJ 07950

Please send me _____ *The Best of Sync, Volume One*, at $9.95* plus $2.00 postage and handling each. Outside USA add $3.00 per order. **#6M**

☐ **PAYMENT ENCLOSED $**_____ *Residents of CA, NJ and NY State add applicable sales tax.

☐ **CHARGE MY:** ☐ American Express ☐ MasterCard ☐ Visa

Card No._____ Exp. Date_____

Signature_____

Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City_____ State_____ Zip_____

☐ Send me a FREE *Creative Computing* Catalog.

take considerable extra steps to set the PRINT position back to its original value. Just be careful you do not POKE out the ENTER character at the end of the line (go off the screen on the right) or POKE values into the variables area (go off the screen on the bottom). Either bug can cause the system to crash, or at best goof up the display file and variable values. Also beware of using it unless the display file is padded out, i.e., you either padded it out previously if you have 1 or 2K, or if it is automatically padded by using 4K or greater RAM.

Lines 210-220 initialize your position (D,E), and 380-390 randomly initialize the Minotaur's position (H,I) making sure he is no closer than five spaces to your starting position. These respective positions are then stored in B,C and F,G in case the proposed move is illegal (i.e., a NO-GO area) in lines 400-440. At line 450 it is decided whether the Minotaur's proposed move will be random, or directed towards your position. In lines 620-640 the player's proposed move (or bail-out) is made.

If either move is illegal, the positional variables are restored to their original values (lines 532-550 and 680-710.) Lines 670-675 POKE ("print") the previous positions (leaving a path or track), and 720-725 display the current position of you (CHR$ "O" = 52) and the Minotaur (CHR$ "M" = 178). If your position matches the Minotaur's (line 730), you get eaten; if you escape (line 728), you win. A new maze is set up (same density) when you press "P".

After typing in the program and insuring against errors, type in the values of the numeric variables used as constants (J,K,L,O,P,Q,R,S,T,U,V). Then SAVE the program to tape by typing GOTO 1100. After the program has SAVEd, it will display the title page. The screen then goes blank for about 40 seconds while the computer sets up the maze. The game begins when the maze appears.

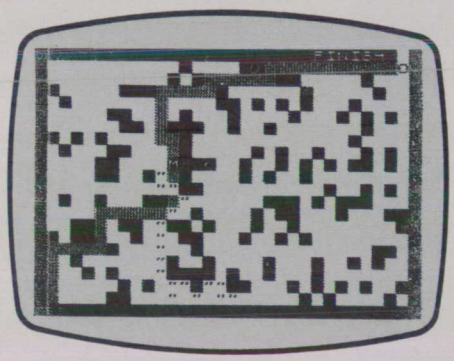
You start out in the lower left-hand corner of the maze, represented by a flashing "O". Somewhere in the maze (but at least five steps away) lurks the Minotaur, shown as a flashing inverse "M". To move, hold down the appropriate "arrow" key ("5" through "8"). You cannot penetrate the dark portions of the maze, nor can you recross your own path or back up. If you happen to get an insoluble maze, or if you wish to bail out, press "1" and the computer will set up a new game.

To exit, press "BREAK". (But do not use CONTinue, as this will cause strange things to happen when the display file is compacted and the POKEs change bytes in the variables area on a 2K machine; there would be no use for this anyway, as the screen is cleared when CONT is entered.)

If you wish to change the density of the maze, type GOTO P (or GOTO any number less than 11). Then enter a number between 0 (no obstructions) and 1 (completely filled in)—.5 is the practical maximum and often results in insoluble mazes. Changing the density also changes the Minotaur's tactic (see line 450). At higher densities his motion becomes more random to keep him from getting stuck. At lower densities you cannot miss a step, as he will usually go straight towards you. Densities in the vicinity of .25 to .3 seem to give the best game.

To restart the game after a BREAK with the same density (but a new maze), type GOTO T (or GOTO any number between 11 and 20).

If you use your taped copy of the program on 2K machines, be sure to SAVE it from a 2K machine (or RAMTOP variable 16389 POKEd at 72). If you SAVE after entering the program into a 4K or greater machine, the whole display file is recorded and will not load into a 2K machine in the future.



Modifications

To make it possible to re-trace your path, change line 680 to:

680 IF PEEK (DF+D*L+E)<V THEN GOTO 720

For the ultimate challenge, play "Diagonal Minotaur," in which your only allowed moves are the four diagonal directions represented by "T", "Y", "G", and "H". Make the following deletions if you do not have a RAM pack.

10 (delete) (set DN in immediate mode.)
70 (delete)
80 (delete) (to make room)
620 LET D=D-(INKEY$="T" OR INKEY$="Y")+(INKEY$="G" OR INKEY$="H")
630 LET E=E-(INKEY$="T" OR INKEY$="G")+(INKEY$="Y" OR INKEY$="H")

Since doing all these INKEY$s takes time, you can "panic" when you get stuck by rapidly jabbing the buttons, and eventually get through to an "illegal" position. This is possible even with the "normal" version—it is possible, for instance, to go diagonally up and to the right if you are stuck, by alternately pushing "7" and "8" as fast as you can.

If you have a RAM pack, the possibilities are only limited by your imagination and the machine's speed. If you have the room, you will probably want to translate all the GOTO's, etc. to numbers instead of variable letters to make it easier to work with, and provide more complex win/lose displays.

Have fun on your journey through your display file!

```
  10 INPUT DN
  20 CLS
  30 FAST
  40 FOR A=P TO V-T-T
  50 PRINT "■■■■■■■■■■";
  60 NEXT A
  70 PRINT AT S,U-T;"""MINOTAUR"
"";AT U-T,U-T;"B■ F.NACHBAUR"
  80 PAUSE U+U
  90 LET DF=PEEK K+0*U*PEEK (K+P
)
 100 FOR H=P TO T
 110 FOR I=0 TO U
 120 POKE DF+H*L+I,(RND<DN)*U
 130 IF (H<R+P AND I>U-0) OR (H>
T-R AND I<S) THEN POKE DF+H*L+I,
0
 140 NEXT I
 150 NEXT H
 160 SLOW
 200 PRINT AT O,T+R;"FINISH■ "
 210 LET D=T
 220 LET E=0
 380 LET H=INT (RND*T+P)
 390 LET I=INT (RND*T+S)
 400 LET B=D
 410 LET C=E
 430 LET F=H
 440 LET G=I
 450 IF RND>(P-DN) THEN GOTO J-T
 460 LET H=H+SGN (D-H)
 470 LET I=I+SGN (E-I)
 480 GOTO J+T
 492 LET H=H+INT (RND*R-P)
 500 LET I=I+INT (RND*R-P)
 510 LET H=H+(H=0)
 532 IF PEEK (DF+H*L+I)<U THEN G
OTO T*U
 540 LET H=F
 550 LET I=G
 620 LET D=D-(INKEY$="7")+(INKEY
$="6")
 630 LET E=E-(INKEY$="5")+(INKEY
$="8")
 640 IF INKEY$="1" THEN GOTO T
 670 POKE DF+B*L+C,R+S
 675 POKE DF+F*L+G,U-T
 680 IF PEEK (DF+D*L+E)<U AND PE
EK (DF+D*L+E)<>R+S THEN GOTO 720
 700 LET D=B
 710 LET E=C
 720 POKE DF+D*L+E,52
 725 POKE DF+H*L+I,178
 728 IF D=O AND E=U THEN GOTO U*
U
 730 IF D=H AND E=I THEN GOTO T*
T*U
 740 GOTO T*T
 820 PRINT AT T+P,O;"YOU WERE EA
■■■■";
 830 GOTO U*L
 961 PRINT AT T+P,O;"***YOU ESCA
■■■■";
1023 PRINT "■PRESS P TO PLAY■"
1030 IF INKEY$<>"P" THEN GOTO J*
0
1050 GOTO T
1100 SAVE "MINOTAUR"
1105 GOTO T
```

Graphics line notes:

50: Inverse space (8)

70: In inverse letters "BY F. NACHBAUR"

200: In inverse letters "FINISH(inverse space)".

820: In inverse letters "YOU WERE EATEN.(inverse space)".

961: In inverse letters "***YOU ESCAPED**".

1023: In inverse letters "PRESS P TO PLAY".

NEW FROM **D-RAM**

FOR SINCLAIR ZX81/TIMEX 1000 — 8K ROM/16K RAM

STAR DUEL **$9.95***
A deadly duel between you and an unpredictable enemy scoutship that has intruded into Earth Council space. No levels - no gimmicks; you either win or lose. Your only aid is a unique library to help you outwit your foe. 1 player.

STARSHIP CRISIS/PLANET QUIZ **$9.95***
"STARSHIP CRISIS" is a suspenseful game where knowing the facts about the Solar System is all that can save you. 1 player or a group.
"PLANET QUIZ" is an educational quiz game on our Solar System. Learn while having fun. A score is kept for each player. 1 to 4 players.

MINDREADER-1 ..... **$4.95***
Amaze your friends as your computer appears to read minds. Two games - **MATRIX** and **CLOCK**. Confusing fun. Group play.

**All programs are recorded on quality cassettes. Prices include handling and shipping.*

D-RAM Products
4352 GROW ROAD, NW
STANTON, MI 48888

PUT YOUR TIMEX/SINCLAIR COMPUTER TO WORK!

TIMEX/SINCLAIR SOURCEBOOK™

- SOFTWARE
- HARDWARE ADD-ONS
- BOOKS/CATALOGS

Maximize your ZX80, ZX81 or TS1000 computer investment with the TIMEX/SINCLAIR SOURCEBOOK which lists programs, hardware accessories and reference books.

The SOURCEBOOK allows you to quickly identify the ZX computer products you need from a wide variety of sources to put your computer to work. Order your copy today — over 600 listings — only $6.95.

TIMEX/SINCLAIR SOURCEBOOK™
Micro Design Concepts
Dept. SC-2
P.O. Box 280
Carrollton, TX 75006

Please send me the TIMEX/SINCLAIR SOURCEBOOK. I enclose $6.95 plus $1.25 P&H ($2.50 outside the U.S.) Add sales tax in Texas.

Name _____

Address _____

City _____

State/Zip _____

Have a product you would like listed?

☐ Check for an application for free listings.

TIMEX-SINCLAIR ZX81 1000

1983 Directory

- **Where to find:** Disk Drives, RAM Extensions, Printers, Modems, Keyboards, Game & Serious Software, Books, Periodicals, Programming Aids, and other Exciting Accessories!
- **Articles on:** Special applications like Control Circuitry, Enhanced Graphics, Voice Generation, Music Synthesis, Video Inversion, Light Pens, Joysticks, etc.
- **Complete Descriptions:** We'll tell you what it is, what it does, how much it costs, and where to buy it.
- **Jam-packed w/photographs:** We knew you'd want to see what these products look like. So, we got pictures and put them in!

Only $5.00 ... Postpaid!

To Order: Send check, money order, or VISA/MC number and expiration date. MN residents add 6% sales tax.

Dealer Inquiries Welcome.

E. Arthur Brown Company
Dept. ZA-1 — 1702 Oak Knoll Drive
Alexandria, MN 56308 — Ph: 612/762-8847

LEARN TO PROGRAM

Text and File Organizers with
ZX DATA FINDER

A high capacity information storage and retrieval tool for 16 K Timex and Sinclair Computers.

Advanced file input and editing routines are thoroughly analyzed.

Comprehensive search and display methods are fully explained.

AN ADVANCED COURSE IN DATA HANDLING

Free specifications are available, or send $9.95 for program listing and text to:

THOMAS B. WOODS
P.O. Box 64, Jefferson, N.H. 03583

COMPUTER ENGINEERING SERVICES

The Jarrett Company
P.O. BOX 1222
SHOW LOW, ARIZONA 85901

THE MOST COMPLETE SOURCE OF SERVICES FOR THE COMPUTER ENTREPRENEUR

Software Duplication on Cassette.
Marketing/Publication/Packaging/
Manufacture and Prototyping.
Write for Free Brochure!

ZX-80 8K ROM USERS

Completely expand your ZX-80 with 8K Rom to a ZX-81 with full use of *Fast* and *Slow*. Smooth flicker free performance!

Complete Kit: $32.50 & $2.50 postage & handling; PCB only $19.95 & $1.25

The Expandable ZX-80 and ZX-81 TS-1000 / Microace Too

A book of hardware projects that you can build yourself, from memory expansion to speech synthesis. Only $9.95 & $1.25 p&h.

(Dealers Inquiries Invited)

SERIOUS PROGRAMMERS

"MUST-HAVE" UTILITIES
For ZX-81 and T/S 1000 Computers

FILE•SYS — $10
Read/Write Cassette Data Tape Files
(fast, flexible, reliable)

FILE•BASIC — $15
Save/Merge/Erase BASIC Segments
(includes FILE•SYS functions)

FILE•VARS — $5
Save/Restore Strings & Arrays
(requires FILE•SYS or FILE•BASIC)

BASIC•OLAY — $10
Overlay/Copy BASIC Segments
(permits full use of 64K RAM)

Simple user interface via USR function
Well-documented user manuals
Available on tape cassette in relocatable machine lang.

SASE for info — Check or MO delivers now

SiriusWare
6 Turning Mill Road
Lexington, MA 02173

ZOR KHAN®

is THE NAME to remember for your ....

TIMEX AND SINCLAIR

SOFTWARE
•
ENTERTAINMENT
•
EDUCATIONAL
•
HOME MANAGEMENT

PLEASE SEND me your latest software catalogue. I enclose $1.00 P&H that will be credited on my first order.

NAME _____

ADDRESS _____

_____ ZIP

☆ **ZOR KHAN** ☆
BOX 31569
AURORA, COLO.
80041

16K ZX-81 Software

VIDEO CALC
The electronic spreadsheet P&B uses on our P&L now available for home, office, or scientific use.

KPL-KID'S PROGRAMMING LANGUAGE
For kids who like to do graphics programs but find Basic a bit difficult-age 5 to 105.

ENCRYPTOR
Turns plain text onto 5-letter code groups and vice versa. Use your own key or ENCRYPTOR supplies.

ESPANOL
Electronic bi-lingual dictionary which will learn your own vocabulary. Japanese coming soon.
$9.95 each cassette inc. postage.
Also: Trek, Animals, Market
SASE for more Info.

P&B Software
1155 E Malibu Drive
Tempe AZ 85282

just for fun

Generally *SYNC* prefers articles in some depth to help you get more out of your computer. However, we receive many short programs that illustrate a point, demonstrate a technique, or show something the reader has found interesting. "Just for Fun" shares these programs with you. If you learn something, great. If you have some fun, great. If you have some that you want to share, send them to: Just for Fun, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

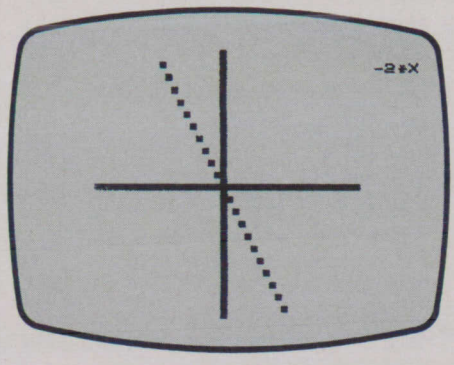
Four Quadrants

Tuan Ton

After plotting a few functions on the ZX81, I found that it could plot only on the first quadrant of a plane. So I developed this program which graphs an input function on all four quadrants.

Type in the program, press RUN and ENTER.

After the axes are drawn, enter your formulas in response to the L cursor in "slope and Y-intercept" form. For example, SQR Y - X = 0 must be changed to y = x * x and enter the "X*X" leaving out the y. Try entering: X*X; -4*X; 2**X; -2*X.



Lines 10-40 draw two axes (x-axis, y-axis); this gives a full sized plane (four quadrants) with the origin in the middle of the screen instead of in the bottom-left corner. The origin can be moved by changing the constant in lines 20 and 30.

Line 70 automatically sets your X value for the most fitting value for Y that can be plotted.

Tuan Ton, 6837 Carnegie Dr., Richmond, VA 23226.

```
  1 FAST
 10 FOR X=0 TO 43
 20 PLOT 21,X
 30 PLOT X,21
 40 NEXT X
 50 INPUT F$
 60 FOR X=-21 TO 21
 70 IF VAL F$+21>42 OR VAL F$+2
1<0 THEN GOTO 90
 80 PLOT X+21,VAL F$+21
 90 NEXT X
100 PRINT AT 1,23;F$
```


BARLOG SOFTWARE

Announces:

▷2K GAMES PACK:◁

Invasion From Mars

Pyramid

Both on a quality cassette for $7

▷MACHINE CODE STARTER◁

16K-3 sub-routines explained $7

make checks to:

Bob Lucas
401 N. Geyer Rd.
Kirkwood, MO. 63122

EDSON ELECTRONICS OFFERS

Educational programs for grades 1-4 that reinforce what they learn in school. We also offer a digital display load monitor for monitoring data from the cassette to the computer.

Write to
Edson Electronics
P.O. Box 151211
Tampa, Fl. 33684
for free info.

IMPORTED GAME CASSETTES
TIMEX-ZX81 $14.95 EACH

"WINEED AVENGER" JUST RELEASED!!
"CONDITION RED" JUST RELEASED!!
"CASINO" NEW RELEASE!! INCLUDES POKER-MACHINE, SUDDEN-DICE, FIVECARD AND CHUCK-LUCK.
"TRADER JACK" FANTASTIC FUN GAME BUSINESS LOGIC-SOUTH PACIFIC LOCAL "10 GREAT GAMES" PACMAZE, GOBLER, STARDEFENDER, VAMPIRES, SUICIDE, MINEFIELD, FROGLER, MINITREK, BOMBER AND DICTATOR.
"DO NOT PASS GO" MONOPOLY TYPE FOR UP TO 6 PLAYERS-AVAILABLE IN SPANISH, BRITISH OR AMERICAN LANGUAGE VERSIONS. PLEASE SPECIFY.

SAVAGE SOFTWARE, PO BOX 441
TITUSVILLE, FL. 32780

Everyone and his brother are copying video game ideas so we will too.

INTRODUCING . . . Help
PITFALL FRED

similar to Famous Atari video game cited in Omni Magazine December issue as one of the 10 best video games of 1982. Run through the jungle avoiding pits, snakes, and quick sand, while hunting for gold and money (16K version also has tarpits, fuzzballs, silver and gems) 1K, 2K, 16K version available (please specify)

Pitfall Fred $3.95 for cassette. Plus $1.00 for shipping.

NY residence add 28¢ sales tax

FROG SOFTWARE COMPANY, P.O. box 95, Glenmont, NY 12077 or call between 4-5 pm (518) 465-6552

*mention Sync Magazine and get an amusing but otherwise worthless program FREE

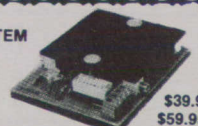
"For Adults Only"

An adult program to add spice to your life. Not a game, but an aid to better understanding of your lovers desires. You'll enjoy this program if you enjoy loving . . .

$19.95 + 1.50 p&h
Florida resident add 5% tax

HAYMARKET SOFTWARE CO.
• P.O. BOX 14026 • JACKSONVILLE, FLORIDA 32238

VOTEM



$39.95 (KIT)
$59.95 (A&T)

ANALOG INTERFACE FOR THE ZX81

Welcome your computer to the "real world" of analog signal processing. VOTEM is a complete package, consisting of the necessary hardware and software to enable your computer to measure voltages and temperatures. VOTEM also includes circuitry that conditions the tape signal for dependable LOADs.

- Software compatible with Timex TMS-1000, Sinclair ZX81/80-8K)
- Requires absolutely no modifications to computer
- Measures voltages and temperatures
- Probe provided for air and liquid temperature measurements
- Resolution is better than 14 bits (0.00005V or 0.04 degrees C)
- Voltage range of +1V can be expanded with on-board resistors
- Low power, requires less than 20mA at +11V unregulated
- Can be powered from computer's supply (cable included)
- Tape signal conditioning circuitry
- Tape signal monitoring capability (audio and visual)
- Manual includes detailed kit assembly and calibration
- Software for calibration and applications fits in 1K RAM
- Instructions for adapting to other Z80 computer systems
- Compact, 1" by 4" by 3"

Also, static RAM chips, 6116P-3 (2K by 8) with instructions for upgrading Sinclair ZX81 computer from 1K to 2K. Only $11.95 each. Send check or money order. Include $3 shipping and handling.

Down East Computers
P.O. Box 3096
Greenville, NC 27834

tired of space game RIPOFFS?

GRAFICGAMES.

1K FUN

* **GUNFIGHTER** YOU AGAINST ZX BAD GUYS $3.☐
* **7 GAMES PAK -** BLINDLUCK • POP THE BUBBLES+ 6.☐
* **WORD-HUNT** FROM JUMBLED UP LETTERS 4.☐
* **CARTOONMAKER*** LIVE ACTION GRAPHICS! 6.☐

PICK ANY 2 FOR $3. ALL 5 FOR $6.
SuperGraphiCreator ☐ Magic Calendar ☐ IDEA KIT ☐
Multi-memory Galculator ☐ Geometric Patterns + ☐
* ALL 15 - 1K PROGRAMS FOR JUST $20.00 * ☐

16K ESCAPE

* **SHOWDOWN** GUNSLINGERS of the OLD WEST $5.☐
* **CROSSWISE** A CROSSWORD GAME FOR 2 6.☐
* **1 ARM BANDIT** LIVELY SLOT MACHINE ACTION 6.☐
* **CARTOONMAKER 16*** EXPANDED ACTION! 8.☐

* ALL 4 - 16K PROGRAMS $20.00 ☐* * TOTAL $ *
* ALL 19 (1K & 16K) $35.00! ☐* make your own cassettes & save! we pay postage

* both include Animator's kit

*THE*GAME*
ROOM©

P.O. BOX 5367 N. HOLLYWOOD, CA. 91616

BACK ISSUES OF
SYNC

Add to your *Sync* collection today, while copies are still available. The more complete your library of back issues, the more authoritative and useful it will be to you.

The earliest available issue is January/February 1981. Order any issues you wish, being sure to specify the month and year for each. If a particular issue is out of stock, your payment will be refunded promptly.

Back issues of *Sync* are priced at $4.00 each, postpaid. Outside the U.S.A., $5.00 each.

SYNC
Dept.NA4S, 39 E. Hanover Ave., Morris Plains, NJ 07950
Please send volumes of *Sync* listed below:

Mo. & Yr.	Quantity	Unit Price	Total Price

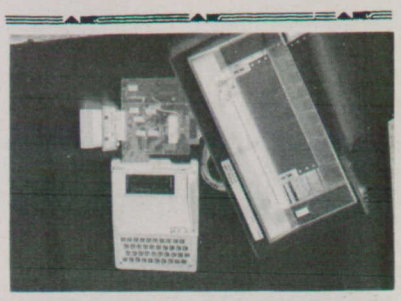
PAYMENT ENCLOSED $_____
(NJ residents add 5% sales tax.)

Mr.
Mrs.
Ms._____
(please print full name)

Address_____

City_____

State/Zip_____



PRINTER INTERFACE

CENTRONICS STYLE PARALLEL PORT PRINTER INTERFACE ENABLES USER TO PRINT ALPHANUMERICS, AND SELECTED GRAPHICS SYMBOLS USING THE 8K-16K ZX-80,ZX-81, OR THE TIMEX 1000 WITH THE AXIOM GP-100A PRINTER.

(Also compatible with other Centronics Standard Printers.)

PRINTER COMMANDS AND M/L PROGRAMS ARE STORED IN AN 8K MEMORY AREA NOT USED BY COMPUTER.PROGRAMS ALLOW PRINTOUT OF LISTINGS,SCREEN DISPLAYS, M/L CODE, TEXT--32 COLUMNS FOR LABELS, WIDE LETTERS,ETC., OR 63 COLUMNS WIDE FOR LETTER-SIZE PAPER.

CASSETTE PROGRAMS,I/O BOARD (SEE LEFT),**EXTRA 8K ROM BOARD WITH 2K ROM AND 2K CMOS RAM** AND WITH COMPLETE INSTRUCTIONS----------$105.50

SPECIAL BASIC PROGRAMS CAN BE STORED IN 2K CMOS RAM FOR INSTANT RECALL.

CUSTOM PROGRAMMED 2K ROMS----------$15

I/O BOARD

PROGRAMMABLE 8255 PIO BOARD FOR MICROACE,ZX-80,ZX-81 OR TIMEX 1000 (8K-16K) CAN BE USED WITH ONE INPUT PORT AND TWO OUTPUT PORTS,OR THREE OUTPUT PORTS. EACH LINE CAN BE TURNED ON OR OFF ON ONE OUTPUT PORT.

FOUR OUTPUT LINES PROGRAMMABLE WITH 1US. PULSES.

RESET LINE BROUGHT OUT ON I/O BOARD.

OTHER UNITS CAN BE PLUGGED IN TO I/O BOARD (EXTRA +5 VOLT POWER MAY BE REQUIRED)

I/O BOARD WITH PROGRAMS AND INSTRUCTIONS----- $45

PROFESSIONAL ELECTRONICS
109 CHESNEY LANE COLUMBIA,S.C. 29209

VERIFY

A SOFTWARE ALTERNATIVE TO HARDWARE MONITORS

A Machine Code Program designed to **VERIFY** that the program you thought you saved is reloadable without having to clear the memory by reloading. **EITHER** embed **VERIFY** into important programs **OR** use as a programming aid.

DOCUMENTATION INCLUDES

- Full instructions for implementation
- Program listing $3.00
- Cassette $5.00
- 16k required
- For ZX81 and T/S1000 computers

WI residents add sales tax

SPACE BREAKER
P.O. Box 8104
Green Bay, WI
54308

STILL STRUGGLING . . .

with your tax return? Let the 1982 TAX RETURN HELPER compute your Form 1040 and Schedules A, B, C, D and E. The cost — $14 — is tax deductible.

WHAT YOU CAN DO WITH TS-ARTIST

You create graphics on the screen with a pencil, an eraser, about 120 brushes, a video inverser and a "flicker". You can easily move these tools in 8 directions or along lines and circles which are drawn, erased, painted with a brush, video inversed or "flickered". You can set a different background to any quarter of the screen. You can define new graphic commands — for example one that "does" a square. Then by pressing only one key you can make any of the tools do a square anywhere on the screen; so a square can be drawn, erased, etc.. And the square can be compressed or expanded to any size and it can be used as a building block for other commands you define. And you can save or print your artwork. And . . . TS-ARTIST is fun; is a screen editor that can mix text with graphics; is a smart educational device (ages 4 to 99) that indirectly teaches (LOGO-style) concepts in arithmetic, geometry and computer science. All this power (and more) for only $12.95 (add $1.50 or $2.50 outside U.S. s & h) For TS1000/ZX81 (16K RAM). KSOFT, 845 Wellner Rd. Naperville, IL 60540.

AT&A

T/S 1000 ZX81 ZX80 MICROACE COMPUTER CENTER

Holds Computer W/ 16K Secure. Space for Recorder and Printer. Has built in plugs, L.E.D. Load Monitor, On/Off SW., Cass. Stor. Solid Wood. Dark stain or blk.
31Lx16Dx7H $124.95 + $7.00 S/H
Or Unit without T.V. Mount 21Lx12Dx7H
$99.95 + $7.00 S/H. USA Only

A.T&A Comp-U-Ware
2712 G. Street, Middletown, Ohio 45042

AT&A

SOFTWARE AUTHORS

Frog Software is looking for video games, languages, and *all* good software. Big royalties and (or) instant cash paid for rights.
Send us your programs for review or send $1 for details
FROG SOFTWARE, LTD.
BOX 95
GLENMONT, NEW YORK 12077

CREATE YOUR OWN GAMES!

10 1K Programs Reveal Moving Graphics Techniques. Planes, D&D, Tanks and More.

Listing of All 10 — $3.00

Q&M PUBLISHING
Dept. SC, 255 N. 1600 W. 76
Provo, UT 84601

Brainchild Computer Works, Inc.
Microprocessor Design & Development
Hardware - Software - Peripherals
Consulting - Contract - Prototypes

P. O. Box 506
Pewaukee, WI 53072

Phone:
(414) 691-3903

Hi-Res "Draw It"

John Herriott

Using the program "Draw It" by Robert Boynton (*SYNC* 2:4) as a basis, the program below allows for relatively fine detail drawing using the Hi Res Graphics Board made by Memotech. The resolution provided by this board is 248 (X) by 192 (Y) dots.

The first seven lines are in Basic and allow for the setting of the starting point of the drawing. The ZX81 keys 5 to 8 are used to draw the lines (without SHIFT). 0 is used to erase and can be used also to move to a new spot on the screen. It would be wise to make the spot appear from time to time (by pressing 0 a second time) otherwise you will lose track of it.

STARCH is a composite command provided by the Memotech board. PLOT and UNPLOT are similar to the ZX81 statements.

The resultant work of art can be passed into a long string which can then be saved on tape.

Readers might find the process of drawing a lot easier if the "keys" are operated with the eraser end of the pencil. Pressure is positive and response immediate—not always the case with fingers on the ZX81 keyboard!

John Herriott, 143, LeMarchant Rd., St. John's, Newfoundland, Canada A1C 2H3.

```
    5 REM "DRAW"
9680 PRINT "INPUT X. (MAX. 247)"
9682 INPUT X
9684 CLS
9685 PRINT "INPUT Y. (MAX. 192)"
9687 INPUT Y
9689 CLS
9700 LET V=40000 (19000 for 16K)
9710 LET Z$="STARCH"
9712 GOSUB 9990
9720 LET X=X
9722 LET Y=Y
9723 LET Z=0
9730 LET Z$="PLOT"
9735 GOSUB 9990
9740 IF INKEY$="5" THEN LET X=X-1
9742 IF INKEY$="8" THEN LET X=X+1
9745 IF INKEY$="6" THEN LET Y=Y-1
9747 IF INKEY$="7" THEN LET Y=Y+1
9750 IF INKEY$="0" THEN GOTO 9770
9755 GOSUB 9990
9760 GOTO 9730
9770 LET Z$="UNPLOT"
9775 GOSUB 9990
9780 IF INKEY$="5" THEN LET X=X-1
9782 IF INKEY$="8" THEN LET X=X+1
9785 IF INKEY$="6" THEN LET Y=Y-1
9787 IF INKEY$="7" THEN LET Y=Y+1
9790 IF INKEY$="0" THEN GOTO 9730
9800 GOSUB 9990
9810 GOTO 9770
9990 RAND USR 8192
9991 RETURN
```

3-D Cube

Joe Chaiet

Type in the program, type SLOW and ENTER, then RUN and ENTER. Press any key as you normally would. Press again. Notice what happens when you hold the key down. When the error code appears, press RUN and ENTER to play again.

Joseph Chaiet, 25 Cherry Hill Rd., New Paltz, NY 12561.

```
 10 FOR X=1 TO 20
 11 IF INKEY$="" THEN GOTO 11
 20 PLOT 19+X,43
 25 PLOT 19+X,23
 26 PLOT 29+X,33
 27 PLOT 29+X,13
 60 PLOT 20,43-X
 61 PLOT 30,33-X
 62 PLOT 49,33-X
 65 PLOT 39,43-X
 70 IF X>10 THEN GOTO 220
130 PLOT 39+X,43-X
160 PLOT 39+X,23-X
190 PLOT 20+X,23-X
215 PLOT 20+X,43-X
220 NEXT X
```

Blastoff

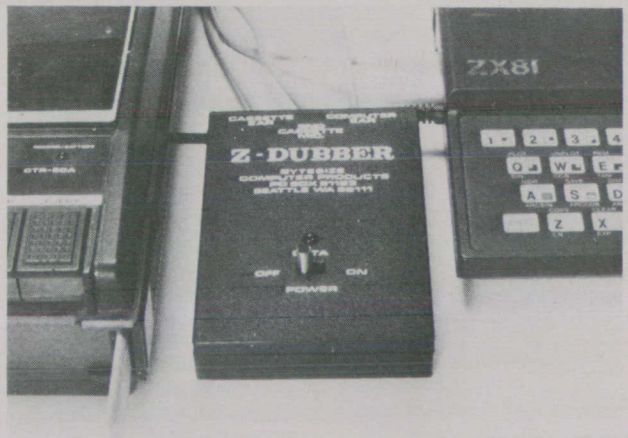
Glenn A. Osborn

"Blastoff," which uses SCROLL with graphics for 16K, contains one of those

Glenn A. Osborn, 2624 Gunckel, Toledo, OH 43606.

NO MORE BAD CASSETTE LOADS with THE Z-DUBBER

The frustration of trying to load a cassette program into your Sinclair ZX80/81 or Timex 1000, is this what you really bought your computer for? **Why put up with it? Now you don't have to.** The Z-Dubber is a small device which connects between your computer and cassette player, improving your loading ease 100%.



The Z-Dubber also allows you to connect two tape recorders together, to create perfect duplicates of your favorite cassette programs. The Z-Dubber can be yours for $31.95 postage paid within the U.S. area. Money back guarantee if not satisfied. Visa & Mastercard welcome.

BYTESIZE COMPUTER PRODUCTS
PO BOX 21123 - SEATTLE WA 98111
206-236-2066

END DATA STORAGE HASSLE

THE ZX 80/81 IS A GREAT LITTLE COMPUTER!-BUT, IT DOES HAVE DATA STORAGE PROBLEMS, WE ALL KNOW THAT. THE DATA CONDITIONER II CURES THIS AND MAKES USING THE ZX 80/81 PURE JOY. IMAGINE NOT HAVING TO READJUST CABLES WHEN YOU SAVE AND LOAD. OR HOW ABOUT NOT HAVING TO WORRY ABOUT THE WRONG VOLUME CONTROL SETTING OR HAVING A VISUAL TAPE CUEING CAPABILITY OR A CASSETTE REMOTE CONTROL AT YOUR FINGERTIPS. THESE ARE THE FEATURES YOU HAVE WITH THE DATA CONDITIONER II IN YOUR SYSTEM. EASY TO USE AND REASONABLY PRICED AT JUST $49.95!! GET ONE TODAY! (PLEASE ADD $3.50 FOR SHIPPING AND HANDLING)
FOR TOLL FREE CHARGE CARD ORDERING CALL 24 HOURS A DAY
1-800-367-5134
USE YOUR VISA MASTERCARD OR AMERICAN EXPRESS CARDS
FOR INFORMATION WRITE
COMMUNICATIONS SYSTEMS LABORATORIES
94-165 LEOKANE STREET
WAIPAHU, HAWAII 96797

For Timex Sinclair users too!

The Gateway Guide to the ZX81 and ZX80

by Mark Charlton

The Gateway Guide is a practical programming manual for the beginner that furnishes over 70 fully documented programs. The majority of the programs have been written for easy conversion from machine to machine (Timex Sinclair, ZX81, 4K ZX80 or 1K ZX80). *The Gateway Guide* describes each function and statement, illustrates it with a demonstration routine or program, and combines it with previously discussed material to provide a solid basis for understanding your computer.

For faster service
PHONE TOLL FREE: 800-631-8112
(In NJ only: 201-540-0445)

5½" x 8", 172 pages
$9.95

Also available at your local bookstore or computer store.

CREATIVE COMPUTING PRESS
Dept. NA7Q, 39 East Hanover Ave., Morris Plains, NJ 07950

Please send me _____ *The Gateway Guide to the ZX81 and ZX80* at $9.95* plus $2.00 postage and handling each. Outside USA add $3.00 per order. #160

☐ **PAYMENT ENCLOSED** $_____ *Residents of CA, NJ and NY State add applicable sales tax.

☐ **CHARGE MY:** (Charge and phone orders $10 minimum.)
☐ American Express ☐ Visa ☐ MasterCard

Card No._____ Exp. Date_____

Signature_____

Mr./Mrs./Ms._____
(please print full name)

Address_____ Apt._____

City/State/Zip_____

☐ Send me a FREE *Creative Computing* Catalog.

THE EXPLORER'S GUIDE TO THE ZX81

If you have ZX81 then you need this book (120 Pages).

1K and 16K Programs.
Games and Application.
RAM and I/O Circuits.
Programming Hints
ROM Routines.

$11 from:

TIME DATA
3 - Waldon Road
Califon, N.J. 07830

Enclosed _____ Check/M.O.
Name _____
Address _____
City _____ State _____ Zip ____

YORK 10™ BASF-DPS

WORLD STANDARD TAPE

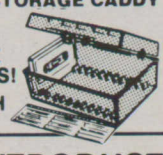
MONEY BACK GUARANTEE

PREMIUM 5-SCREW SHELL FITS ALL STANDARD RECORDERS

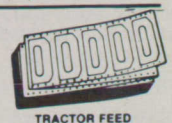
COMPUTER GRADE BLANK CASSETTES

DATA TRAC / C-05, C-10, C-20

CASSETTE STORAGE CADDY
NEW! ORGANIZE YOUR TAPES! $2.95 EACH



FINEST QUALITY PHILIPS (NORELCO) TYPE HARD BOXES



TRACTOR FEED DIE-CUT BLANK CASSETTE LABELS

INTRODUCTORY OFFER!
ORDER 2 DOZ CASSETTES AND 1 CADDY
GET 1 CADDY FREE! ORDER 4 DOZ CASSETTES AND 2 CADDIES — GET 2 FREE

HERE'S WHAT USERS SAY ABOUT YORK 10 CASSETTES:

"We monitored the output to the computer with a specially built meter and found absolutely no dropouts throughout the tape . . ."
Stace Papadopoulos
Beaverton, OR

"It's nice to have a tape you can rely on 100% of the time to perform with such quality. And the fast, courteous service was a pleasant surprise."
Tom Parkinson
Madison, OH

"YOU'VE TRIED THE REST, NOW BUY THE BEST"

VISA **Call: 213/710-1430** for IMMEDIATE SHIPMENT on Credit Card Orders. MasterCard

ORDER NOW . . . YORK 10™ Computerware
MAIL TO: 24573 Kittridge St., Dept. S-3 Canoga Park, CA 91307

ORDER FORM

ITEM	1 DOZEN	2 DOZEN	TOTAL
C-05	☐ 7.50	☐ 13.50	
C-10	☐ 8.00	☐ 14.40	
C-20	☐ 10.00	☐ 18.00	
Hard Box	☐ 2.50	☐ 4.00	
Storage Caddy @ $2.95 ea.	Quantity _____ FREE Quantity _____		
Blank labels	☐ 4.00/100	☐ 30.00/1000	
		SUB TOTAL	
Calif. residents add 6% sales tax			
Shipping/handling 1 doz. $2, 2 doz. $3.50, 3 doz. $4.50, each additional doz. $.50			
For Parcel Post instead of UPS ADD $1			
Outside Continental USA, ADD $2			
		TOTAL	

Each cassette includes two YORK 10 labels only. Boxes are sold separately. Shipments are by U.P.S. unless Parcel Post requested. Boxes, caddies, and blank labels are free of shipping charges when ordered with cassettes. When ordered without cassettes, shipping charges: Boxes—$1.00/doz. Caddies $1.00 each. MINIMUM SHIPPING/HANDLING ON ANY ORDER—$2.00

Check or M.O. enclosed ☐ Charge to Credit Card: ☐ VISA ☐ MASTERCARD

☐ **PLEASE SEND QUANTITY DISCOUNTS**

Card No._____ Exp._____

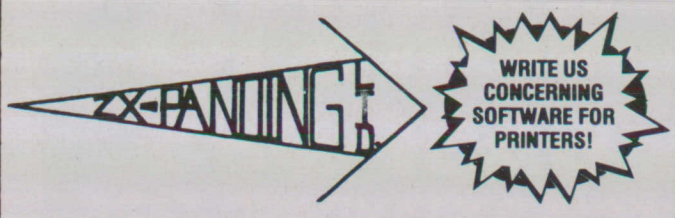
Name_____

Address_____

City_____ State/Zip_____

Signature_____

Computer make & model_____ Disk?(y/n)____



NOW AVAILABLE A DATA STORAGE SYSTEM THAT ALSO OFFERS GRAPHING CAPABILITIES!

DATA STORAGE AND DISPLAY STYSTEM — 16K — stores up to sixty data points in up to twenty-five files under user-defined titles. Data can then be recalled in either a tabular form or as a solid graph accompanied by a brief data summary including file sum, mean, range, and closing data. Useful in any field — business, home, investments, scientific experimentation —anywhere that numbers are important. Others sell mere storage programs for **$21.95** to **$29.95**; we offer these extended capabilities on cassette for .. ONLY **$14.75.***

Specially labeled 30 minute data storage tapes for ONLY $1.95.*

CHECKBOOK, INCOME TAX AND BUDGET ORGANIZER—16K A powerful yet easy to use finance program—10 jobs in menu driven format. Checks and deposits are totaled and itemized under desired categories for budget planning and income tax preparation. Makes checkbook balancing easy. Ninety transactions manipulated at one time with 16K, many more with extended memory .....ONLY **$13.75***

ZX-PANDING, LTD. is a growing company, but we still hold true to our original goals of having useful programs at reasonable prices with easy-to-read instructions. Each program is on cassette and is thoroughly tested. For a free catalog send a large self-addressed stamped envelope.

ZX-PANDING, LTD.
P.O. BOX 25
NEWTON, NC 28658

*ALL orders please add $1.25 to total order to cover POSTAGE AND HANDLING. (Foreign orders add $2.00 to cover air costs. Your payment must be in a U.S. dollar draft payable to U.S. bank.)

o o EZRA GROUP II
o o EZRA GROUP II

LOW LOW LOW LOW LOW LOW LOW LOW LOW PRICES!

Biorhythms 8K ROM/1K&up.....1.00
Graphics Billboard 8/lup.....1.00
Horse Race 8/lup.....2.00
Truth Value Programming.....1.95
Plotting Work Sheet 8/1.....3.95
Plotting Work Sheet 8/16.....6.95
SPINNER TM(like Rubik's)8/16...2.00
Improved SLOW PAUSE.....1.00
Linear Regression 8/lup.....2.00
CHEWTER TM(like Pacmn)SLOW/lup.2.95
Dog Race 8/lup.....1.95
Random MUSIC!SLOW/1 up.....2.00
TAP WRITER TM(Handicap Aid)8/1.free
CHAR. Generator Demos 8/lup....2.95

ORDER,SASE,reSASE gets you GOO-DIES Catalog and !!FREE!! Program

• • (Dealer Inquiries Welcome)

EZRA GROUP II
EZRA GROUP II

POB 5222 San Diego,California 92105
POB 5222 San Diego,California 92105

NEW PRODUCTS FROM COTTAGE TECHNOLOGY

ACZ GENERAL LEDGER—a complete double entry accounting system designed for the TIMEX/Sinclair computer. This menu-driven system generates a trial balance, income statement, balance sheet, statement of owners' equity, and a post closing trial balance. It can handle any combination of up to 400 entries and accounts per session, and sorts 150 entries in 10 seconds. Data is automatically transferred from program to program; no tedious re-entry is required. Some of the many options include a chart of accounts, offset accounts, a provision for a proprietorship or partnership and much more. This powerful yet easy to use system is complete on three cassettes, with a detailed instruction manual. (16K) $29.95

EASY GRAPH converts your data into a fast, flicker-free bar graph display labeled with the appropriate scale and title. Just enter the data (ranging in size from 1 to 1,000,000) and let EASY GRAPH do the rest. When "saved" the program retains past data for easy updates. (16K) $9.95

PROTECTOR—a fast-moving skill game for 2 players. Protect your planet from 4 types of attacking fighters. Variable skill levels—the longer you play, the more challenging it gets. (16K) $9.95

YOU'RE THE BOSS—a business simulation game. You make the production and marketing decisions. For fast growth, invest the profits in new products and factories. Guide your company through booms and recessions, pitfalls and opportunities. A game of strategy for 1 or 2 players. (16K) $9.95

THE LAST CASSETTE/16K FIX—Having problems with SAVE/LOAD when the 16K module is attached? This small modification reduces ram pack noise at the signal source. Kit and instructions $1.95

VIDEO MONITOR OUTPUT—A small pigtail allows you to connect your TIMEX/Sinclair to a NTSC-compatible standard video monitor for a crystal clear display. Parts and instructions $2.95

REVERSE VIDEO MODULE—Convert your TIMEX/Sinclair to the standard white letters on a dark background for better readability and a more professional appearance. Module and instructions $8.95

Texas residents add 5% sales tax — All prices USA
Foreign residents add $2.00 shipping and handling.

cottage technology®

5720 W. Little York
Suite 178
Houston, Texas 77091

TEXT + PRODIR

TEXT - A program for easy text editing, storage and display. Recall pages of reports, letters, etc. without splitting words at the end of a line. PRODIR - A programed directory to organize programs and ease loading. Prodir can be used to provide a table of contents for your reports or chapters contained on your tape. $10 16K cassette

TEXTII

The only program you need to compose, edit and save pages of letters, essays, resumes, reports, address books, collections and home inventory. Pages are recalled without splitting words at the end of a line for professional display and printouts. Everything TEXT & PRODIR has but TEXT II INCLUDES:
I. A variable length right margin to allow adjustable column lengths to accomodate your printer. Column length can adjust from 1 character per line up to the full length capability of your printer.
II. STRING - A string search routine to locate words, phrases etc. in your text.
III. RENUMBER - A line renumbering routine to open up space for inserting new sentences and paragraphs in your text.
This program set is ideal for journalists, businesses, students, busy housewives and the hobbiest. $20 16K cassette

DATAPLOT

Plot stock and metal prices, interest rates, scientific data, etc. with this versatile program. DATAPLOT will plot positive and negative free formated data stored in REM statements. Draws and lables the axes, titles your plot and connects your data points. DATAPLOT will also draw figures, plot from an equation and plot on a grid if necessary. $10 16K cassette

BLACKJACK

Hit, stand, double down, split and take insurance with this Nevada casino game. Deals out a complete deck before shuffling. $10 16K cassette

FUNMATH

First grade math with creative graphics to help your children learn and review while having fun. Five 2K programs covering addition, subtraction, time telling and more. Developed by a certified teacher. $20 2K cassette

string

A routine you can add to your programs to search for commands, words, and phrases. Perfect for locating phone numbers, program statements, etc. $2 2K listing

renumber

A line renumbering routine for your programs. $1 2K listing

VISA/MASTERCARD ACCEPTED. Please include name, address, card number, expiration date, and signature.

Peak P.O. Box 8005 Suite 231, Boulder, CO 80306-8005

serendipitous little accidents that I found amusing: the slow dispersion of the rocket smoke caused by the CLS command at line 260.

Type in the program, press RUN and ENTER, and you are on the way.

Graphics line notes:
70: Q,W.
80: Inverse U, inverse space.
90: Inverse S, inverse space.
100: Inverse A, inverse space.
110: Q, inverse space (2), W.

```
 10 REM "BLASTOFF"
 20 PRINT AT 10,10;"BLASTOFF"
 30 PAUSE 50
 40 CLS
 50 LET A=16
 60 LET B=10
 70 PRINT AT   A,B;"  ▄▄"
 80 PRINT AT A+1,B;"  U█"
 90 PRINT AT A+2,B;"  S█"
100 PRINT AT A+3,B;"  A█"
110 PRINT AT A+4,B;" ▄██▄"
120 PRINT AT 0,0;"ARE YOU READY
TO BLASTOFF?"
130 PRINT "1=YES, 2=NO"
140 INPUT A
150 IF A=1 THEN GOTO 170
160 IF A=2 THEN GOSUB 300
170 PRINT AT 3,0;"COUNTDOWN"
180 FOR G=10 TO 0 STEP -1
190 PRINT G
200 NEXT G
210 PRINT AT 21,0;"BLASTOFF"
220 FOR H=1 TO 22
230 PRINT AT 21,10;"   **"
240 SCROLL
250 NEXT H
260 CLS
270 PRINT AT 10,10;"""A-OK"""
280 STOP
300 PRINT AT 5,0;"       TOO LATE
"
 305 PRINT AT 6,0;"       ITS TAKI
NG OFF ANYWAY."
 310 PAUSE 25
 320 RETURN
```

Train

Joe Chaiet

Type in the program, put the computer in SLOW mode and press RUN and ENTER. Watch the cute display. Then try constructing your own vehicle.

Graphic notes:
10: Inverse space (31).
50: Space; inverse space (2); space (2); inverse space.
60: Space (2); inverse space (6).
70: Space; inverse space (7).
80: Space (2); letter O; space; letter O; space (2); letter O; Y.

```
  1 LET B=6
  2 PRINT AT 5,5;"**HERE COMES
THE TRAIN**"
  3 FOR S=1 TO 50
  4 NEXT S
 10 PRINT AT 21,0;"███████████████
████████████████"
 20 FOR A=0 TO 23
 21 LET B=B+1
 23 IF A>3 AND B<27 THEN PLOT (
22-A),B
 40 PRINT AT 17,A;
 50 PRINT ;" ██  █"
 60 PRINT TAB (A);"  ██████";
 70 PRINT TAB (A);" ███████";
 80 PRINT TAB (A);"  O O  OY";
 90 IF A>3 AND B<27 THEN UNPLOT
(22-A),B
100 NEXT A
105 CLS
106 FOR W=1 TO 20
107 NEXT W
110 GOTO 1
```

Random Rectangles

Joe Chaiet

Type in the program, type SLOW and ENTER, and then RUN and ENTER. Now sit back and enjoy the display. The program will continue generating the display until the computer runs out of memory. Therefore, the more memory you have the longer the program will run. Obviously, with 1K the run is rather short.

Graphic notes:
20: Inverse space.
56: Inverse space.
66: Inverse space.
90: Inverse space.

```
  5 LET T=INT (RND*20+2)
  6 LET D=INT (RND*14+2)
  7 PRINT AT (10-D/2),(14-T/2);
 10 FOR X=1 TO T
 20 PRINT "█";
 30 NEXT X
 35 PRINT TAB (14-T/2);
 50 FOR X=1 TO D
 55 PRINT TAB (14-T/2);
 56 PRINT "█";
 57 FOR U=1 TO T-2
 60 PRINT CHR$ D;
 65 NEXT U
 66 PRINT "█";
 70 NEXT X
 75 PRINT TAB (14-T/2);
 80 FOR X=1 TO T
 90 PRINT "█";
100 NEXT X
110 GOTO 5
```


ANNOUNCING a new software program for TIMEX/ SINCLAIR TS1000 and SINCLAIR ZX81 computers. (Requires 16K RAM memory pack)

LOST IN SPACE

by Michael C. Hoffman

You're the captain of an experimental space ship that can't be detected by enemy ships.
Suddenly, an electrical fire is reported by the navigator. It is quickly extinguished, but the damage is severe.
The auto-pilot, main engine and laser gun won't respond, so you switch to manual and auxiliary thrusters. The only working controls are the rotate right and left thrusters. Checking the status monitor indicates only 30 lbs of fuel is left.
During the crisis, your ship wandered into a meteor shower. You must maneuver left or right to avoid hitting meteors and enemy ships.
Your new mission is to locate the fleet of friendly fuel ships and attempt to land on one in order to refuel and continue the journey.

FEATURES:

Rotate right and left thrusters. 2 types of meteors. 2 types of enemy ships. 1 fleet of friendly fuel ships. 10,000 bonus points. Bonus game. 30 lbs bonus fuel. Status monitor for fuel and score (Real-time). Auto-run. Many prompts. Manual replay. Moving graphics. Flicker-free. Moving graphic title for the beginning and end of program.

CONTROLS:	**Press key #**
Rotate right thruster	8
Rotate left thruster	5
Status monitor for fuel left and score	Ø
Manual replay (When prompt asks if you want to play another game; yes or no?)	Y (**ENTER**) (or) N (**ENTER**)

As you steer past the meteors and enemy ships, you accumulate valuable points. Try to land on a fuel ship to refuel (30 lbs bonus fuel) and continue into hyperspace. (10,000 bonus points will be added to your current score and to the new game already in progress.)

"LOST IN SPACE" is prerecorded on a computer certified cassette tape, in a protective see through ABS plastic case. GUARANTEED LOADING. Included is our detailed instruction manual.
(File name) **"LIS"** $11.95
(Please add $1.50 for shipping and handling. NJ residents 5% tax.)
(Dealers wanted.) M.C.HOFFMAN CO., PO BOX 117, OAKLAND, NJ 07436

HAYMARKET SOFTWARE CO. • P.O. BOX 14026 • JACKSONVILLE, FLORIDA 32238

NEW AND EXCITING PROGRAMS FOR YOUR 8k/16k-ZX80-ZX81-TS1000

FOR NEW AND EXCITING PROGRAMS YOUR 8k/16k-ZX80-ZX81-TS1000

Quant.		Each	Total
____	"FOR ADULTS ONLY" Not a program for kids. Fun for couples!!	$19.95	$.
____	"ZX-BLACK HOLE" For 1 or 2 players, this game teaches logic!	$10.95	$.
____	"MAZE-O-TREASURE" See who can score the most on computers maze.	$ 9.95	$.
____	"HAYMARKET HANGMAN" Choose from 5 categories. Computer learns!	$ 9.95	$.
____	"ZX-CONCENTRATION" 1 or 2 players, good game for children.	$ 8.95	$.
____	"MAZE-O-RAMA" Compete for fastest time, new maze each time.	$ 9.95	$.
____	"FLIP-FLOP" Challenging game for 1 or 2 players. 5 levels.	$10.95	$.
____	"ROAD RACE" How far can you go before hitting something?	$ 9.95	$.
____	"SPACE TREASURES" Collect all the jewels you can. (high score)	$ 9.95	$.
____	"PARTY PATTERNS"/"TOWERS OF HAYMARKET" 2 for the price of 1. Short but fun.	$ 9.95	$.

All Haymarket Programs are fully guaranteed to load and operate as advertised! All programs are on tape twice to aid in loading.
Watch our ads for new Adventure Games coming soon from Haymarket.

TOTAL OF ORDER	$.
FLORIDA RES. ADD 5% TAX	$.
SHIPPING & HANDLING	$ 1.50
TOTAL AMOUNT ENCLOSED	$.

☐ CHECK ☐ MONEY ORDER

Ricochet

James John Hollandsworth

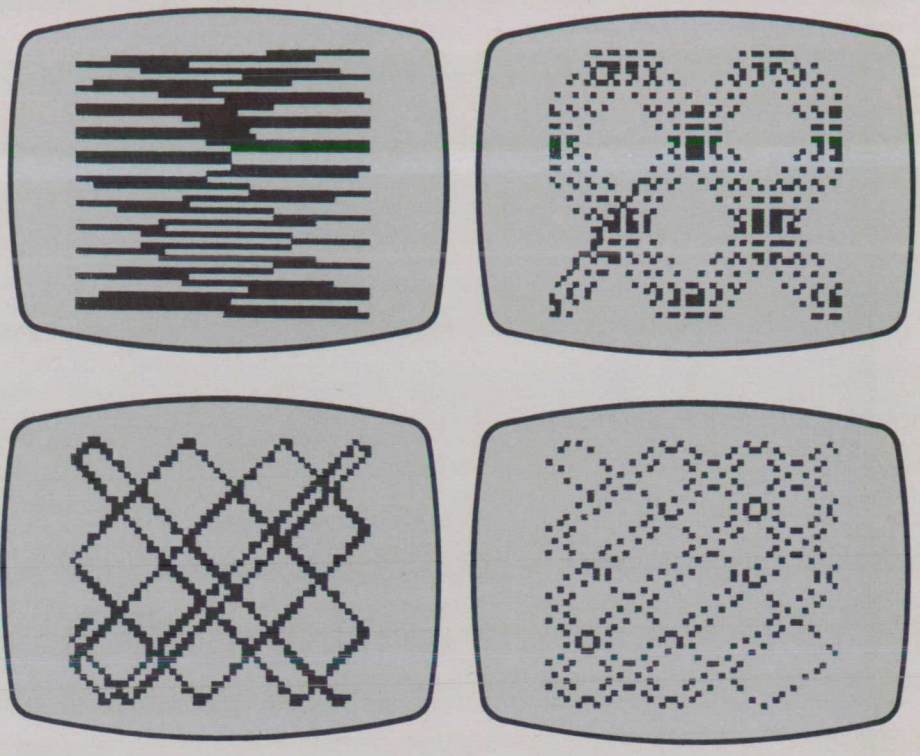
Enter the listing as printed. Be sure your computer is in SLOW mode. If you do not have SLOW mode, type in 11 PAUSE 5. Press RUN and ENTER. Then observe the results. If the program gives error code 4, the letters H and E in lines 3 and 4 may be changed to letters with lower character codes.

Line notes:

5 and 21: PI is a Function on the M key.

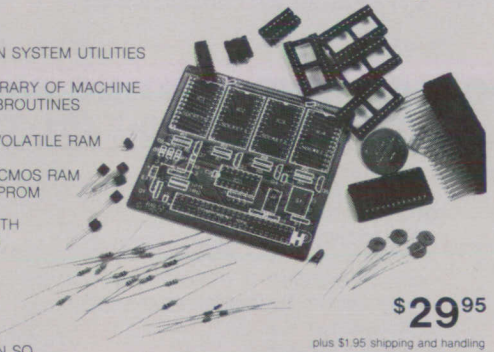
James John Hollandsworth, Box 163, Montcoal, WV 25135.

```
 3 LET N=CODE "H"
 4 LET A=CODE "E"
 5 LET G=NOT PI
 6 LET E=RND*VAL "4"-VAL "2"
 7 LET M=RND*VAL "4"-VAL "2"
 8 LET X=RND*N
 9 LET Y=RND*A
10 PLOT X,Y
13 LET X=X+E
14 LET Y=Y+M
15 IF X<G THEN LET X=G
16 IF Y<G THEN LET Y=G
17 IF X>N THEN LET X=N
18 IF Y>A THEN LET Y=A
19 IF X=G OR X=N THEN LET E=-E
20 IF Y=G OR Y=A THEN LET M=-M
21 GOTO PI*PI
```



Extend your ZX81/TS1000: Add Memory that won't Forget!

- ADD YOUR OWN SYSTEM UTILITIES
- BUILD UP A LIBRARY OF MACHINE LANGUAGE SUBROUTINES
- UP TO 8K NONVOLATILE RAM
- USE HM6116LP CMOS RAM OR 2716/2732 EPROM
- COMPATIBLE WITH 16K RAM PACKS
- AS REVIEWED IN SQ, S.U.N. NEWSLETTER, ETC.



$29.95

plus $1.95 shipping and handling

ASSEMBLED VERSION AVAILABLE

INTRODUCTION

This memory board is designed to fill the transparent 8K block of memory (from 8 to 16K) in a ZX81-16K system. This area of memory is an ideal place to store, either permanently or temporarily, machine language routines or data which are to be used by the BASIC system. Such routines could be, for example:

- I/O servicing routines for control applications
- a disc operating (DOS) or other development system
- additional BASIC commands
- EPROM programming and verify routines

A sample rapid display routine, a program — merging routine, and procedures for storing utilities on tape are included with the kit.

The use of HM6116LP 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are nonvolatile — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified. The lithium cell supplied with the board will maintain sufficient reserve power for almost ten years for 2K or for about two years for a fully populated board. A connector is made available for an alternative external supply.

With this board it's no longer necessary to place your machine language routines in REM statements, in string variables, or beyond RAMTOP. You can build up a resident library of machine utilities for use by your BASIC system.

ASSEMBLY

Complete step-by-step instructions in a 20 page manual make assembly of the board easy. Construction takes between two and three hours. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board, all capacitors, resistors, transistors, sockets, connectors, integrated circuits, and the lithium cell. The board is supplied with one 2K CMOS 6116LP-3 RAM — it will accomodate three more for a total of 8K.

Send check or money order for $29.95 plus $1.95 shipping and handling to the address below. The printed circuit board with the instruction manual is available separately for $15.00 post paid. An assembled and tested board, with 2K of memory, will be supplied for $44.95 plus $1.95 shipping and handling. A fully populated board will be supplied for $59.95 plus $1.95 shipping and handling.

HUNTER, 1630 FOREST HILLS DRIVE, OKEMOS, MI 48864

REINDEER ENTERPRISES'—

presents MC FILER

MC Filer is a fast user-dedicated filer program for the ZX81 or ZX80 with 8K ROM. that includes machine code subroutines for maximum storage space and speed of operation. Full documentation on dedicating the program to use as a mailing list, purchase order file, general file, and many more is included. You define file length and up to six criterion in each file for the advanced search. edit. and delete features. No programming knowledge is necessary.

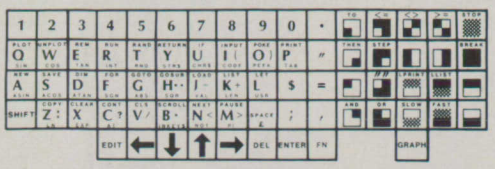
$17.85

arcade style games
worm wars — 7.85
escapees 6.50
reindeer po box 671
Millville N.J. 08332

AUTO-SHIFT KEYBOARDS

$80.00

THESE ARE QUALITY KEYBOARDS SPECIFICALLY DESIGNED FOR SINCLAIR/TIMEX COMPUTERS AND OFFERED ONLY IN KIT FORM TO SAVE YOU ASSEMBLY COSTS. USE OF ACTIVE CMOS CIRCUITRY PROVIDES LOW POWER REQUIREMENTS (ABOUT 1mw) AND ALLOWS THE KEYBOARD TO BE POWERED DIRECTLY FROM THE ZX81 AND TIMEX 1000 POWER SUPPLIES. MORE IMPORTANTLY, SINGLE KEYSTROKE ENTRIES (NO SHIFT REQUIRED) ARE ENABLED FOR 80% OF THE KEYS THAT MUST BE MANUALLY SHIFTED ON THE ZX81, TIMEX 1000, AND MOST OTHER KEYBOARDS THAT ARE CURRENTLY AVAILABLE.



- 73 FULL SIZE KEYS
- DOUBLE SIDED PC BOARD
- SIMPLE ASSEMBLY
- MULTI-COLOR KEY LEGENDS
- SEPARATE GRAPHICS SECTION
- SEPARATE EDITING KEYROW

FOR ADDITIONAL DETAILS SEND SASE TO:

RESEARCH APPLICATIONS PRODUCTS

4561 Paloma Lane

Yorba Linda, CA. 92686

INCLUDE $4.00 SHIPPING & HANDLING

CALIFORNIA RESIDENTS ADD 6% SALES TAX

AMAZING DEVICES

ZX RAM 64K $99

SPEECH INPUT EARS **SPEECH ROCOGNITION** $99

Hugely successful Speech Recognition System, complete with microphone, software and full instructions.
BUILT TESTED & GUARANTEED

MUSIC SYNTHESISER +16 I/O LINE

MUSIC:- STEREO PROGRAMMABLE
INPUT-OUTPUT:- TWO 8bit BIDIRECTION PORT
CONNECT RELAY LED. PHOTOCELL etc **$49**

SPEECH SYNTHESISER -- MOUTH
WITH AMPLIFER + SPEAKER **$99**

REMOTE CONTROL 16CHANNEL $89
(TxRx) WIRELESS.INFRARED:- 4CHANNEL $39
Robot Control

AUDIOVISION
1279N. NORMANDIE.AV.
HOLLYWOOD
C.A. 90027
CALL 213 6605217

VISA MasterCard

Z-80 SOFTWARE NOTEBOOK

A must for anyone wishing to program the ZX-80/81 or TS 1000 in machine language! Contains over 25 useful techniques, utilities and programs that will turn even 1K systems into computing giants.

Sorting, timing loops, searches, block transfers and many more are included. The complete Z-80 instruction set is fully explained and listed. **$7.95 pp.**

BASIC HANDYMAN

BASIC sub routine that will streamline your program and save your valuable time. Puts the experience of advanced programmers at your fingertips!

Sorting, searching, data files, display file handling, screen-save, graphs and special functions galore are given and completely explained. **$6.95 pp.**

FREE TITLE CENTERING ROUTINE WITH ORDER

Z WARE
P.O. BOX 111
ALBANY KTY 42602

ORDER NOW FOR CHRISTMAS

CUSTOM-DESIGNED ATTACHE CASE

FOR
ZX 80/81 & TS 1000

$34.95 PLUS $3.50 P/H

CHECK OR MONEY ORDER

COMPUTA-DEK

6009 KENWOOD DR.
NASHVILLE, TN 37215

WORD PROCESSING
For ZX81/Timex 1000 with 16K 32K 48K or 64K RAM. (Please specifiy RAM version.)
ONLY $7.95 (Limited time only)

ALSO AVAILABLE:
Checkbook Balancer—helps with the monthly chore! Ahamur—are you able to be King? Rule an island to see! Escape—inside a deadly barrier with you are Xroids. Can you guess who's for dinner? Rebel Raider—Dark Faker is coming! You must stop him! Marketing—buy/sell stocks to make your fortune, or nothing! SPECIAL: Any one program for $7.95 add only $2. for each additional program!

MARANATHA
Box 759-C, Mableton, Ga. 30059

TWO GREAT
ADVENTURES IN 16-K

DRY GULCH – Search for Treasure in an Old West Ghost Town.

MORLOCK CASTLE – Will you survive the hunt for the Magic Medallion.

$9.94 Each (on cassette)

Each Interactive Adventure is written in the classic style and has over 100 words of vocabulary.

UPSTATE LABS
27 Elvira Street
Rochester, N.Y. 14606

*** for TIMEX/SINCLAIR computers ***

NEW BOOK: the WATCHMAKERS GUIDEBOOK, product directory & more! 3.95
LOST IN SPACE 11.95
UNIVERSAL INVENTORY FILE 16.95
UNIVERSAL MAILING LIST 10.95
UNIVERSAL COIN COLLECTION 10.95
UNIVERSAL STAMP COLLECTION .. 10.95
UNIVERSAL COMIC BOOK COLLECT 10.95
UNIVERSAL BASEBALL CARD COLL 10.95
UNIVERSAL RECORD ALBUM COLL 10.95

Each program on cassette + manual. (8K ROM, 16K RAM). Please add $1.50 for S&H $1 for cat. (Refunded with order.) NJ 6% tax.

M.C. HOFFMAN CO., DEPT. SC2
P.O. BOX 117, OAKLAND, N.J. 07436

resources

The "Resources" column lists new products for Sinclair users. Suppliers and users are invited to send brief product descriptions and details for ordering to: Resources, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

All programs require the 8K ROM and 16K RAM unless otherwise noted.

User Groups

- **California**
  Carpinteria, CA, area users who want to start a cooperative self-help amateur club contact:
  Harvey Wheeler
  Box 704
  Carpinteria, CA 93013

- **Florida**
  South Florida Timex/Sinclair Users Group. Contact:
  Bob Pearsall
  9220 Fountain Rd.
  Lake Worth, FL 33463

- **Missouri**
  Joplin area users. Contact:
  Jim I. Brown
  PO Box 2221
  Joplin, MO 64803

- **New Jersey**
  Cumberland County area Timex/Sinclair users. Contact:
  Jerry Sweet
  110 Nth 5th St.
  Millville, NJ 08332
  (609) 825-7116

- **Massachusetts**
  The Boston Computer Society. Timex/Sinclair User Group. Publishes a newsletter. For information contact:
  Sue Mahoney, Director
  Sinclair/Timex User Group
  c/o The Boston Computer Society
  Three Center Plaza
  Boston, MA 02108
  (203) 573-5816

New York
SINCUS (Sinclair Computer User's Society.) Contact:
SINCUS
PO Box 92
Glenn Aubrey, NY 13777

- **West Virginia**
  Parkersburg area users interested in forming a group contact:
  Gregory Wentzel
  1209 36th St.
  Parkersburg, WV 26104
  (304) 428-5547

- **Canada**
  Timex Sinclair Users Club
  PO Box 7274, Station A
  Toronto, Ont.
  Canada M5W 1X9

- Sinclair Program Exchange. Join and share your ideas, programs, and product reviews with other users. Several interesting, useful, and fun programs and games in each issue. Sample issue: $2; 6 issues for $10.
  Sinclair Program Exchange
  c/o Jim Schontzler
  1280 Paddington Way
  San Jose, CA 95127

- The Original Program of the Month Club. Wide selection of programs: games, educational, family financial. On cassette: $5.99 or less; every 6th program free; limited ongoing purchase agreement. For new members: first 5 programs for $0.99. For further details (SASE appreciated) write:
  The Original Program
  of the Month Club
  3763 W. Crocus Dr.
  Phoenix, AZ 85023

Business/ Household Programs

- 10 Programs for the 1982 tax return. Menu driven; self-modified; tape saveable; tax deductible; now available are Schedules A/B, C, E, G, SE, and Forms 2106, 2119, 2210, and 3468. Each program: Listing: $4; cassette: $9. (NJ residents add 6 percent.)
  Theodore J. Dunn
  151 Greenville Ave.
  Jersey City, NJ 07305

- *Income Taxes.* Designed to help file your personal income tax form. Step by step instructions to guide you through the IRS forms; explains which deductions to report; does all the mathematical calculation; continuous up-

"CRASH GUARD"
PROTECTS YOUR ZX81 AND 16K RAM MODULE
$19.95

- ★ Eliminates crashes caused by bumping the 16K RAM module
- ★ Helps prevent accidental unplugging of your 16K by small children
- ★ Now you can move your computer without worry

The CRASH GUARD is made of Heavy Gauge Bronze-Colored Acrylic. It has been designed to give you a rugged work base. At the same time, it virtually eliminates crashes caused by bumping the computer or 16K module.

To order by phone, call (816) 353-1690

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Please send me _____ CRASH GUARDS© $19.95 each

☐ Check Enclosed
☐ Master Card
☐ Visa

Acct. No. _____

Exp. Date _____

Add $1.50 for postage & handling

Allow 2 weeks for delivery

EXPENSE CUTTER PRODUCTS, INC.
P.O. BOX 9543 • RAYTOWN, MO. 64133

SHELF CONSCIOUS?

Now you can organize your copies of

SYNC

Now your magazines can be a handsome addition to your decor, well organized, and easy to find, thanks to these durable library-quality cases or binders. They're made of luxury-look leatherette over high-quality binder board. And both styles are custom-designed for this or any other magazine you save, with size, color and imprint selected by the publisher. FREE transfer foil included for marking dates and volumes.

Magazine binders

For faster service, **CALL TOLL-FREE 24 HRS: 800-526-0790**
(In NJ only: 201-540-0445)

hold a year's issues on individual snap-in rods, combining them into one volume. $7.95 each; 3 for $22.50; 6 for $42.95. Mixed titles OK for quantity prices.

Open-back cases

store your issues for individual reference. $6.95 each; 3 for $19.75; 6 for $37.50. Mixed titles OK for quantity prices.

Sync
P.O. Box 5120, Philadelphia, PA 19141

Please send: ☐ Cases ☐ Binders

TITLE	QUANTITY
Sync	
Other _____	

☐ PAYMENT ENCLOSED $_____* Add $1.00 *per order* for postage and handling. Outside USA add $2.50 *per unit* ordered; send US funds only.

☐ CHARGE (Minimum $10)
☐ American Express ☐ MasterCard
☐ Visa

Card No. _____ Exp. Date _____

Signature _____

Print Name _____

Address _____

City _____

State/Zip _____

*Residents of PA add 6% sales tax.

SCIENCE FICTION
Games of Bart Trueheart

SO1: **THE MALTRAXIANS ATTACK** **$9.95**

SO2: **RAID ON COLONY ALPHA** **$9.95**

SCIENCE FICTION ADVENTURES

SOA1: **DETENTION STATION INTRAG** **$13.95**

SOA2: **ESCAPE FROM THE DARK SYSTEM** **$13.95**

FANTASY ADVENTURES
of Simon Swordwielder

MSA1: **LABYRINTH OF THE NECROMANCER** **$14.95**

Part 1 of the adventure of the wand of Kormantu

MSA2: **UNDER THE TEMPLE OF KHARDAM** **$14.95**

Part 2 of the adventure of the wand of Kormantu

All games are for ZX81/TIMEX 1000 16K RAM

All games include cassette instructions and program notes.
Add 10% for postage and handling.
Send cheque or money order to:

TURNER, ELCY & COM.,
P.O. Box 395
Port Huron, MI

AT&A

T/S 1000 OR ZX81

"Assault on Darccos 16K" $7.98
"Assault on Darccos 6K" $7.95
"Atan 2K" $4.95

ALL ON CASSETTES /SHIPPING INC
A.T&A Comp-U-Ware
2712 G. Street, Middletown, Ohio 45042

AT&A

HOW TO build your own **FULL SIZE KEYBOARD** for the ZX80 or MicroAce for **UNDER $20! PLANS $2 ppd** Add JOY-STICKS at the same time!
T. W. VESSELS, Rt. 1 Box 77, Brownsville, KY 42210
Please mention "SYNC/[issue #]"

NEW TIMEX SOFTWARE
Professionally designed ZX-81 programs for business, education, farm, authors, Challenging games, 1041A income tax calculator, powerful word processor. For valuable detailed catalog rush SASE ($1 outside of USA) to:
FRESH TRACKS 27A W. Rayburn Road
Millington, N.J. 07946 ☎ 201-647-0970

SANTA FE INDUSTRIES
WE PRIDE OURSELVES ON BEING ONE OF THE LARGEST INFORMATION CENTERS ON THE SINCLAIR/TIMEX COMPUTERS.
• SOFTWARE — (1K AND 16K) GAMES, ENGINEERING, ACCOUNTING ETC.
• HARDWARE SCHEMATICS — KEYBOARD BEEP, 16 MBYTE MEMORY, I/O, 16K RAM, RS 232 AND MORE.
• MISCELLANEOUS — AMATEUR RADIO PACKAGE, UPDATE INFORMATION ON MODIFICATIONS AND MORE.
FOR INFORMATION WRITE: **SANTA FE** 2342 S. DUNDEE CT., HIGHLAND, MI. 48031.
SIMPLY THE BEST!

TAX DEDUCTIBLE
program package - complete form 1040, itemized deductions, 1982 tax tables. 16K RAM. Send $24.95 ZX1040 Software, 3311 Thomas Dr. Palo Alto, CA 94393. CA add 6½%.

STAR VENTURE GAME:
Seek out and destroy enemy vessels to move up in Star Fleet ranks.
Program listing $2.95
Cassette ..... $4.95 & $1.00 shipping

OTHER PROGRAMS AVAILABLE
SASE for Brochure
Dependable Load monitor $4.95
8K/16K, ZX80/ZX81.

DSBC
P.O. BOX 1251
DOLAN SPRINGS, ARIZONA 86441

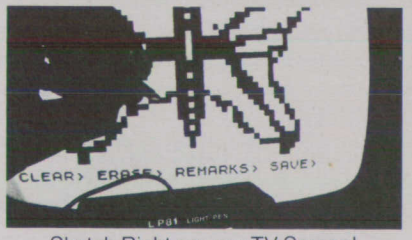
ZX-TS

INCOME TAX $ 8.95
HOME FILE $10.95
FREE MYSTERY PROGRAM FOR ALL WHO INQUIRE ! SUBSCRIBE BEFORE APRIL AND RECEIVE OUR "STAR TREK" TAPE FOR $1.00 !

$ $ for your programs
For free newsletter and program, write to:
z-west
dept. S
BOX 2411 VISTA, CA 92083

Timex 1000 or Sinclair ZX81
NO MORE EYE - STRAIN
ZX81 video inverter adds professional touch.
Displays sharp white characters on solid black background T.V. screen.
A toggle switch lets you choose between normal and reverse.
The small printed circuit board fits on top of the logic chip inside your ZX81
Comprehensive, easy to follow, step-by-step instructions make the modification a simple task.
MONEY BACK GUARANTEE
Ready built $13 including airmail
Send to: D. Fritch
6 Station Road
Thelwall
Warrington
Cheshire
WA4 ZHS
U.K.

LIGHT PEN UNDER $70



Sketch Right on your TV Screen!
Powered by Any Timex/Sinclair

☐ LP81 Light Pen w/cassette $69.95
☐ LP81 Kit $49.95

— Other Plug-on Modules—

☐ RX81 Control Board for 8 I/O Devices Plans & Bare Printed Circuit Board $10.00
☐ CX81 Graphics Board — Recreates 30 new characters Plans & Bare PCB $10.00

Send Check or M.O. to:
East Hill, Oakham, MA. 01068
Send Sase for Info.

dates will be available for changes in IRS forms so the program can be used year after year. Cassette:
Orbyte Software
PO Box 948
Waterbury, CT 06720
(203) 753-8308

- *Wizard.* Asks for stock name, current price, number of shares; calculates broker's commission; asks whether "Call Option" is wanted; displays exact gain and yield. *Portfolio.* Menu driven; holds all pertinent data for up to 10 stocks at a time; calculates gains, yields, length of time held; each stock can be modified or deleted. Both programs on cassette with documentation: $29.95 plus $2 s&h (PA residents add $1.80 sales tax).
M. H. Marks Enterprises
315 Thornberry Ct.
Pittsburgh, PA 15237
(412) 486-1694

- *IPI.* Item Processor & Inventory; inventory program; menu driven; holds about 300 items; alphabetizes, searches, graphics display of quantity of items. Cassette and manual: $19.95.
T. L. McDonald
PO Box 1062
Arcadia, FL 33821

- *Service Department Records.* Summarizes records for a machine service operation; records and summarizes technician number, call codes, and machine model; up to 25 variables; gives percentage of calls for each call code, technician, and machine. Cassette: $25.
Randy Campbell
2843-B Monroe Ln.
Grand Jct., CO 81503
(303) 242-0724

- *Budget Master 1000.* Household budget program; user controlled categories; displays totals in monthly, year-to-date, and average formats. Cassette: $15.95.
Human Engineered Software
71 Park Lane
Brisbane, CA 94005
(415) 468-4900

- *Program 1: ADDR:* $19.95. *Program 2: ACCR*, $19.95. *Loan Analysis*, $9.95.; *Checkbook Record,*. $14.95.
Custom programming and modification. For further information contact:
R. Panwar
2035 Kenland Dr.
Houston, TX 77067

- *ZX Pro-File.* Super fast machine language data base; stores up to 12000 characters in files of any length; single or multiword cross searches, extensive

edit and display functions. Cassette and manual: $19.95.
Thomas B. Woods
PO Box 64
Jefferson, NH 03583

- *Security Plus.* Program codes data, records, files, or personal correspondence using a polyalphabetical substitution cypher system; impossible to decipher without your "key"; stores on tape or printout. Listing and instructions: $5 pp.
Gary Kemper
751 E. Linfield St.
Azusa, CA 91702

Camps

- National Computer Camp, 6th season. At Simsbury, CT, Atlanta, GA, and St. Louis, MO. Dr. Michael Zabinski, Professor at Fairfield Univ., director. For ages 9-18, no experience necessary. For further information contact Dr. Zabinski at (203) 795-9667 or write:
National Computer Camp
PO Box 585
Orange, CT 06477

Math and Science

- *The Matrix Package.* 4 separate topics of matrix multiplication, addition, subtraction, and transformation of user-defined matrices. 2K RAM. Listings with directions: $4.
Stephen Zachev
4859 Elmwood St.
Muskegon, MI 49441

- *Math and Electronics.* Geometry, graphic trig, resonate circuits, Ohms Law, PI and T networks, temperature conversion. Cassette: $14.95. *Book, List, Sort.* Cassette: $10.95. For catalog send SASE.
Soft Way
3308 Midway Dr., Dept. 124
San Diego, CA 92110

Games

- *The Computerized Domino Game.* Adapts traditional game to computer. 28 dominos divided into two ends with a number from 0 to 6. In the arcade version the player plays the computer. For free information write to:
JPR Software
Box 4155
Winter Park, Fl 32793

River Crossing. You are caught in a forest fire; your only escape is to swim down the crocodile infested waters of the nearest river. 1K RAM. Listing: $150.
The Youth Resources Centre
388 Dundas St.
London, Ontario, Canada N6B 1V8

- *Deep Space:* $5.95; *Football* 1 & 2 player versions: $9.95; *Gambler One:* contains Bandit & Roulette: $9.95; *Games Two:* Darts & Mastermind; 2K RAM: $4.95.
Software Development Associates
2240 W. McRae Way, Dept. S1
Phoenix, AZ 85027

- *Supermastermind 1000.* Game rules and easy to read prompts. Cassette: $6.95.
Supermastermind 1000
PO Box 2129
Sheffield Lake, OH 44054

ZX Froggie. Frog must cross road avoiding traffic and hop across the logs to get home. Machine code action; full screen moving graphics; four levels with varying screens and speeds; name and save best score. Cassette: $14.50.
P. Hargrave
Site V, RR 4
Nanaimo, BC
Canada V9R 5X9

- *Space Cruise.* Manuver your ship through different types of asteroids; points and graphics; full instructions. Minimum 2K RAM required. Listing: $1 plus SASE; cassette: $3 plus $1 s&h.
Dennis Young
7833 Rolling Hills Dr.
Jacksonville, FL 32205

USER FRIENDLY SOFTWARE
for the TIMEX/SINCLAIR 1000

Data-Manager (DM)*
Screen prompted data collection system with formula fields and both form and spread and sheet display

Finance-Manager (FM)*
Combines budgeting, record keeping, and check reconcilement into one operation

Program-Manager (PM)*
BASIC and machine code program monitor and utility Functions include: renumber, copy, delete, search, dump, Hex load, Hex Debug, and a condense mode that reduces program memory size.

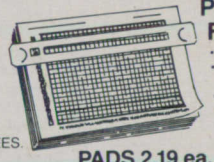
All programs are supplied on cassette with full size instructions that are easy to read and easy to understand. 16K required
$14.95 each postage included
VISA MASTERCARD or check

TOLL FREE ORDERS
1-800-543-3000 ask for
operator #520 ideam code*

CAI COMPUTER ASSISTANCE INCORPORATED
PO BOX 3402 CINCINNATI OHIO 45201 / (513) 381-8778

pleasanTrees
THE PICK OF THE CROP FOR 16K!

NOT THE BIGGEST– JUST THE FINEST.
YOU'LL LIKE WHAT YOU PICK FROM PLEASANTREES.



PROGRAMMING FORM PADS
- All lines *including* edit lines
- Not half sheet—full 8½x11 premium erasable paper
- 50 sheets per pad
- Free coded example of W.C. Fields
- Window Card for easy reading

PADS 2.19 ea. (+ .75/pad P&H)

See what a machine code master & award-winning animator can do for your '81/1000

NOW—ZX–XON!

'81 or 1000 16K

ZXAK-MAN True full-screen version, scoring, multi-level. *This* is the best one . . . 12.95

3-D WORM MAZE Net worms and return to box. Remember *which* box or more escape. Addictingly frustrating . . . 12.95

BOGGLER Great 2-4 player party game. 4 cheat-checks, nice graphics . . . 12.95

5 FUN 'N' GAMES PAK Zxak-mam, states game, mini-boggler, 2 others . . . 12.95

BASE CONVERSION Converts to any base, handy M.C. aid . . . 9.95

City of Xon
scrolls 3 dimensionally while you avoid hazards. Complete craft control. The finest M.C. game . . . 19.95

Please add 1.50 per cassette postage & handling

FOR RELEASE IN MAY
A book *just* on graphic programming. Lots of illustrations, loads of listings. Also invaluable chapters on Memotech's HRG. Master of our forms and Windowcard incl.

ORDER BEFORE MAY 15th AND SAVE 15% OFF INTRO PRICE OF $17.95

PleasanTree's Programming
7760 N. Hopdown Ave.
Tucson, AZ 95741

PROMPT SERVICE

Catalogs/Directories/ Product Lists

- Specializing in educational, business, household, and entertainment programs. For free catalog send legal size SASE to:
  Biocal Software
  340 Cypress Dr.
  Fairfax, CA 94930

- *Allco Computer Cataolg, #3.* Everything you need for your computer can be found in this catalog. Catalog: Free (enclose $1 for shipping which will be refunded with the first order).
  Allco Products Computer Catalog
  PO Box 43074
  Detroit, MI 48243-0074

Publications/ Periodicals

- Screen design aide. Design screen using pixel X & Y coordinates, lines, and columns; graphics character set provided for reference; master suitable for copying. $1 plus legal size SASE to:
  R. Pearsall
  9220 Fountain Rd.
  Lake Worth, FL 33463.

- *Guide to Spectrum Resources.* A complete directory of resources for the Spectrum, including reviews and assessments; illustrated; sections on hardware, software, publications, user groups; cross referenced. £2.50 (overseas £3.00).
  Microscene
  6 Battenhall Rd.
  Birmingham B17 9UD
  U.K.

- *Learning Timex Sinclair Basic* by David A. Lien. Handbook for those with no prior computer knowledge; explains programming step by step; offers special question answer sections at end of many chapters for self-test.
  Compusoft Publishing
  1050-E Pioneer Way
  El Cajon, CA 92020
  (800) 854-6505
  In California: (619) 588-0996.

Educational Programs

- Programs for amateur runners: *Runner's Log, Pace and Splits, Data and Statistics.* Cassette: 16K: $7.95; 2K: $5.95. *Training Program.* Develops individualized running program based on user's age, sex, condition; 16K only: $14.95.

  Music theory and ear training games. Menu driven; levels of difficulty; note reading, intervals, melodic dictation. 16K programs on cassette: $7.95; a few in 2K: $5.95. For free catalog send a SASE to:
  Evansoft Associates
  1246 Elmwood Ave.
  Evanston, IL 60202

Tape Accessories

- Z-Dubber. Interface between the computer and the cassette recorder to help even the most difficult tape to load easily. Allows connecting two recorders together. Operates on 2 AAA cells. $29.95 plus 3 percent s&h:
  Bytesize Computer Products
  PO Box 21123
  Seattle, WA 98111

- A new series of 20 programs for the T/S 1000 and ZX81 using the "Quickload" feature which loads the program up to four times as fast and verifies whether the computer is loading properly. The new line includes 6 business titles, 2 engineering programs, 3 advanced programming aids, 9 games. Priced between $9.95 and $24.95. For further information contact:
  Marilyn Darling, Marketing Manager
  Mindware, Inc.
  15 Tech Circle
  Natick, MA 01760
  (617) 655-3388

Index to Advertisers

Aadvark Technical 29
AT & A Compu-Ware 85,94,70
Active Designs 69
Acts Audio 67
Aaerco 8
Apropos Technology 72
Atto-Soft 60
Audio Vision 91
Barlog Software 84
Bob Berch 6
Bi-Pak 43
Blaze Sanzone 46
Brainchild Company Works 53
E. Arthur Brown & Co. 83, 71
Brown Cottage Ind. 77
Bug Byte 17
Byte Size Products 86
Byte Back Co. 75
CAI Instruments 61
C.E.D. Corp. 79
Cleva Computer Ware 63
Cobra Tech Ltd. 1
Cole Consultants 86
C-20 Magazine 45
Circle Chess 70
Computer Assistance 95
Computer Continuum 11
Computer Engineering Services 83
Compusoft 79
Computa-Dek 91
Computer Trader, The 79
Cottage Technology 88
DK Tronics 40,41
D-Ram Products 83
DSBC 94
Data Assette 35
DoLoops Computer 71
Down East Computers 84
Edson Electronics 84
E-Z Key 51
Expense Cutter 93
Ezra Group II 88
Fresh Tracks 94
D. Fritsch 94
Frog Software 94,71,46,85,62
Full Spectrum 11
Fuller Micro (Zedex) 37
Game Master 11
Gladstone Electronics 48,49
Haymarket Software 94,89
Heath Computer Services 10
Hensley & Assoc. 60
M.C. Hoffman 89,92
Hunter 90
Hurricane Electronics 78
Intercomputer Inc. 7
International Publishing 57
JPR 70
JK Audio 33
Kopak Creations Inc. C3
K Soft 85
L-P Overlay 46
L & G Enterprises 78
Leading Edge C4
Luxtron Inc. 69
Maples William 70
Glen Smith 92
Melbourne House 5
Memotech 24,25
Micro Computers Plus 15
Micro Designs Concepts 83
Micro-80 66
Micro Grafix 70
MicroSync 73
William Mims 85,78
Orbyte Software 23
Oxford 16
P & B Software 83
Panda Software 39
Peak 88
Pleasantries 95
Professional Electronics 85
Q & M Publishing 85
RCO Terminal 77
Harold M. Rabbie 94
Reston Publishing Co. 55
Reindeer Enterprises 90
Research Application Products 91
Rom Pac Applications C2
Santa Fe Industries 94
Savage Software 84
Schneider Parker Jakus 53
Simplex Software 66
Sights & Sound Electronics 60
Sinclair Place 2
Sinware 13
Siriusware 83
Softsync Inc. 21
Southern Computer Systems 65
Space Breaker 85
Spyder Elec. 77
Strategem Cybernetics 33
Stratos 77
Suntronics 31
Synergistic Design 19
Time Data 87
Tree Systems 62
Troiano Software 60
Turner, Elcy and Com 93
Upstate Labs 92
T.W. Vessels 94
Chris White 46
Wiley 47
Woods, Thomas 83
York 10 87
Zor Khan Industries 83
Z X Panding Ltd. 88
Zodex 94
Z Ware 91
Z-West 94
Zyntax 85

"Touch-A-Matic™", Power At Your Finger Tips!

$9.95

KOPAK'S TOUCH-A-MATIC™ gives you the power to type more accurately and much faster. It requires no wires, no soldering. Comes with complete instructions. It's as easy as removing adhesive backing and pressing into position. Positioning is easy. Once in position, you are ready for touch-typing with ease.

Our unique vinyl-key-hold creation will guide your fingers to the correct keys. Finally, touch-typing now possible with your Sinclair* or Micro-Ace*.

This remarkable product, as well as other **KOPAK** items, are now available. Call now to order through MC/Visa or send check/M.O. to **Kopak Creations, Inc.**

TM Trademark of KOPAK Creations, Inc.
Sinclair* is a trademark of Sinclair* Research LTD.
MicroAce* is a trademark of MicroAce*

KOPAK CREATIONS, INC.
(212) 757-8698
Master Charge & Visa Accepted

$1.50 Handling Charge

Dept. SY3 448 West 55th Street, New York, NY 10019 (212) 757-8698

THE PROWRITER COMETH.

(And It Cometh On Like Gangbusters.)

Evolution.

It's inevitable. An eternal verity.

Just when you think you've got it knocked, and you're resting on your laurels, somebody comes along and makes a dinosaur out of you.

Witness what happened to the Centronics printer when the Epson MX-80 came along in 1981.

And now, witness what's happening to the MX-80 as the ProWriter cometh to be the foremost printer of the decade.

SPEED

MX-80: 80 cps, for 46 full lines per minute throughput.
PROWRITER: 120 cps, for 63 full lines per minute throughput.

GRAPHICS

MX-80: Block graphics standard, fine for things like bar graphs.
PROWRITER: High-resolution graphics features, fine for bar graphs, smooth curves, thin lines, intricate details, etc.

PRINTING

MX-80: Dot matrix business quality.
PROWRITER: Dot matrix correspondence quality, with incremental printing capability standard.

FEED

MX-80: Tractor feed standard; optional friction-feed kit for about $75 extra.
PROWRITER: Both tractor and friction feed standard.

INTERFACE

MX-80: Parallel interface standard; optional serial interface for about $75 extra.
PROWRITER: Available standard—either parallel interface or parallel/serial interface.

WARRANTY

MX-80: 90 days, from Epson.
PROWRITER: One full year, from Leading Edge.

PRICE

Heh, heh.

Marketed Exclusively by Leading Edge Products, Inc., 225 Turnpike Street, Canton, Massachusetts 02021. Call: toll-free 1-800-343-6833; or in Massachusetts call collect (617) 828-8150. Telex 951-624.

LEADING EDGE®

For a free poster of "Ace" (Prowriter's pilot) doing his thing, please write us.